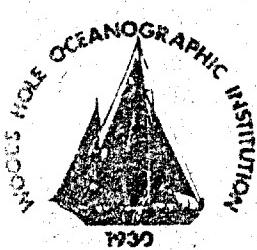


(1)

AD-A210576

Woods Hole Oceanographic Institution



Sea Duct: A Deep-Sea Computer-Controlled Recirculating Flume for the Study of Sea Floor Stability

Appendices —

by

Clifford L. Winget
Arthur R. M. Nowell
William E. Terry
Allan G. Gordon

August 1987

Technical Report

Prepared for the Office of Naval Research, Environmental Sciences
Directorate, under contract Numbers N00014-85-C-0001 and N00014-87-K-007.

Approved for public release; distribution unlimited.

DTIC
ELECTED
JUL 24 1989
S B D

89 7 24 043.

REPORT DOCUMENTATION PAGE		1. REPORT NO. WHOI-87-1, Appendices	2.	3. Recipient's Accession No.
4. Title and Subtitle Sea Duct: A Deep-Sea Computer-Controlled Recirculating Flume for the Study of Sea Floor Stability - Appendices		5. Report Date August 1987		
7. Author(s) Clifford L. Winget, Arthur R. M. Nowell, William E. Terry, Allan G. Gordon		8. Performing Organization Rep't. No. WHOI-87-1, Appendices		
9. Performing Organization Name and Address Woods Hole Oceanographic Institution Woods Hole, Massachusetts 02543		10. Project/Task/Work Unit No. N00014-85-C-0001 N00014-87-K-007		
12. Sponsoring Organization Name and Address Office of Naval Research Environmental Sciences Directorate		13. Type of Report & Period Covered Technical		
14.				
15. Supplementary Notes This report should be cited as: Woods Hole Oceanog. Inst. Tech. Rept., WHOI-87-1, Appendices.				
16. Abstract (Limit: 200 words) The Sea Duct Ocean-Bottom Laboratory is a computer controlled recirculating inverted flume for the <i>in-situ</i> study of sediment transport. It is designed to measure the sea floor response to controlled currents analogous to those generated by surface waves, tidal, or deep ocean storms. The external support frame is an equilateral triangle with sixteen foot sides. It is 12 feet high, has an air weight of 12,500 lbs., and a 2800 lb. submerged weight. Three lead acid battery packs located at the vertex of the triangle legs provide power for the recirculating water pumps, hydraulic power, and ancillary equipment. The inner rotatable structure consists of a 4 foot long by 2 foot wide open bottom windowed test section that is 9 inches high. It is connected to 30 feet of 8 inch tube configured as an elongated toroid. Above the test section is a traverse carriage with stereo camera, flash, and a laser Doppler velocimeter to measure fluid stresses. Internal flow velocities are controlled and can be ramped up to approximately 2 ft/sec providing shear stress sufficient to scour sand, silts, and fine clays. Water and sediment sampling devices obtain specimens from inside and outside the test section. These appendices include sample programs, flow charts, logic formats, electronics drawings, listing of electronics manufacturers, etc. Keywords: Ocean bottom sediment transport; Underwater oceans -				
17. Document Analysis a. Descriptors 1. recirculating flumes; 2. sediment transport 3. sediment stress. (e dc) b. Identifiers/Open-Ended Terms c. COSATI Field/Group				
18. Availability Statement: Approved for publication; distribution unlimited.		19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages	
		20. Security Class (This Page)	22. Price	

Appendix A

Sea Duct Sequencer Program Generation and Sample Program

Sea Duct sequencer programs are written in a high level language designed specifically for the Sea Duct. An example of a sequencer program is found in this appendix. The specific commands are described in the electrical section of this text. The commands may be put in a text file (source code) using a word processor in the non-document mode. The file is given a ".MAC" extent and then assembled and linked using Syscon's M13 and L13. An example of typical commands to the assembler and linker are given on the first page of the following sequencer listing. The output listing is given a ".PRN" extent. The output file (object code) may be loaded into RAM or EPROM for use in Sea Duct. Details of the assembly / link procedure may be found in Appendix A and in the Syscon Manual.

When read by the assembler, each high level command is converted into a string of sequencer Pseudo Program Codes (PPCs). Each high level command is called a macro-instruction. During assembly, an "INCLUDE" file labeled ISDEQ.MAC is added to the source file and is used to translate from the macros to the PPCs. See line 45 of this example. Although the actual file listing is inhibited in this example, a copy of the file is present at the end of the listing. It is possible to use higher level macros to call other macros and to create macro subroutines. Several examples of these may be found in the file ISDSUB.MAC which is also included at the end of this appendix.



Accession For	
NTIS GRA&I <input checked="" type="checkbox"/>	
DTIC TAB <input type="checkbox"/>	
Unannounced <input type="checkbox"/>	
Justification _____	
By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or Special
A-1	.

2 ;
3 ; SEA DUCT SEQUENCER PROGRAM
4 ;
5 ; KNRR Cruise # 127 SEPT 86
6 ; SEA DUCT DEPLOYMENT - EXP #
7 ;
8 ; SUBTTL 4KNR127 28 SEP 86
9 ;
10 ; PREV. VERSION 3KNR127 27 SEP 86
11 ; PREV. VERSION 2KNR127 26 SEP 86
12 ; PREV. VERSION 1KNR127 25 SEP 86
13 ; PREV. VERSION 8KNR126 23 SEP 86
14 ; PREV. VERSION 6KNR126 18 SEP 86
15 ; PREV. VERSION 1KNR126 08 SEP 86
16 ;
17 ;
18 ; W. E. TERRY
19 ;
20 ; INCLUDE FILES REQUIRED:
21 ; ISDSEQ.MAC ; Sea Duct PPC Macros
22 ; ISDDAT7.MAC ; Sea Duct Data series subroutine
23 ; ISDSUB.MAC ; Sea Duct Sequencer Macro subroutines
24 ;
25 ; Note: Radix is set to base 16 in ISDSEQ.MAC - All parameters passed to
26 ; the macro calls (ie. all parameters) must be HEX (ie. 10D not allowed).
27 ;
28 ;*****
29 ;
30 ; Assemble using M18 SDDEEPn,-SDDEEPn/R/C
31 ;
32 ; Link Using L18 /P:3000/D:3700,SDDEEPn,SDDEEPn/N/X/E
33 ; for ".HEX" file. Use MBASIC EXRCA to get ".RCA" file.
34 ;
35 ; Link Using L18 /P:3000/D:3700,SDDEEPn,SDDEEPn/N/E
36 ; for ".COM" file. Use BURN to burn a prom.
37 ;
38 ; Form is: M18 Source,-Relocatable/R/C
39 ; CREF 80 Relocatable=Print file (then erase .C3F file)
40 ; L18 /P:Prog start addr/D:Data start addr,Relocatable,Options
41 ; File extents can be omitted. See Syscon Manual for details.
42 ;
43 ;*****
44 ;
45 ; INCLUDE ISDSEQ.MAC
46 ;
47 ; ; SEA DUCT SEQUENCER PPC MACROS
48 ;
49 ; ; ISDSEQ.MAC 15 JUL 1986
50 ;
51 ; ; W. E. TERRY
52 ;
53 ; ; (Listing Supressed)
54 ; .LIST
55 ;
56 ; ; .SALL ; Use for generation of object code only.

MACRO-18 3.36
4KMR127 28 SEP 86

PAGE 1-1

57 .XALL ; Use for generation of object code with source code
58 ; .LALL ; Use for generation of complete macro text.
59 ;
60 PAGE

61
62 ;*****
63 ;
64 ; SEA DUCT PINGER CODES
65 ;
66 ;
67 ; 0 Program Start, 8 Off the bottom
68 ; End Transmiss. Test,
69 ;
70 ; 1 Start Transmiss. Test, 9 OK to lift and move to
71 ; Beginning Rotation, a new position
72 ; On Bottom,
73 ;
74 ; 2 End of Rotation A XYZ Position Error
75 ;
76 ; 3 Start of Insertion B Rotation Error
77 ;
78 ; 4 Insertion "OK" C Tilt "OK"
79 ;
80 ; 5 Insertion "Bad" D Tilt "Bad"
81 ;
82 ; 6 Start Core E
83 ;
84 ; 7 Start of Velocity F Ready to drop weight
85 ; Measuerment Series
86 ;
87 ;*****
88 PAGE

39 ;***** SEA DUCT SEQUENCER PSEUDO PROGRAM BEGINS HERE *****
90 ;
91 ;
92 ;
93 ; While on deck we record individual system batteries. Time is
94 ; included to block the transmissometer beam as a check.
95 ;
96 0000' START: INITC ;INITIALISE, CLEAR COUNTERS
97 0000' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
98 ;
99 0001' E031 + ADON ;A/D, TRANSMISSOMETER, RECORDER ON
100 DW 0E031H ;A/D ON
101 0003' E041 + TRON
102 DW 0E041H ;Transmissometer ON
103 0005' E051 + SDON
104 DW 0E051H ;Sea Data Recorder ON
105 ;
106 0007' 3000 + SEND 0 ;SEND PINGER CODE 0
107 DW (3000H + 0) ;Push Pinger Code on ASTK
108 0009' E024 +
109 000B' E0C0 + CAMERA ;CHECK THE CAMERA
110 DW 0E0C0H ;Take a Picture
111 ;
112 ;
113 000D' E011 + BAT 1 ;RECORD BATTERY #1 VOLTAGE
114 DW (0E010H + 1) ;Pulse Main Battery Relay #n
115 ; BAT. #1 ON FOR 20 SEC, OFF FOR 20 SEC.
116 000F' 60 + WAIT20
117 DB 60H ;Go to Sequencer Subroutine
118 DW W20
119 0012' E011 + BAT 1
120 DW (0E010H + 1) ;Pulse Main Battery Relay #n
121 0014' 60 + WAIT20
122 DB 60H ;Go to Sequencer Subroutine
123 DW W20
124 ;
125 ;
126 0017' E012 + BAT 2 ;RECORD BATTERY #2 VOLTAGE
127 DW (0E010H + 2) ;Pulse Main Battery Relay #n
128 ; BAT. #2 ON FOR 20 SEC, OFF FOR 20 SEC.
129 0019' 60 + WAIT20
130 DB 60H ;Go to Sequencer Subroutine
131 DW W20
132 001C' E012 + BAT 2
133 DW (0E010H + 2) ;Pulse Main Battery Relay #n
134 001F' 0409' + WAIT20
135 DB 60H ;Go to Sequencer Subroutine
136 DW W20
137 ;
138 0021' E013 + BAT 3 ;RECORD BATTERY #3 VOLTAGE
139 DW (0E010H + 3) ;Pulse Main Battery Relay #n
140 ; BAT. #3 ON FOR 20 SEC, OFF FOR 20 SEC.
141 0023' 60 + WAIT20
142 DB 60H ;Go to Sequencer Subroutine
143 DW W20
144 0026' E013 + BAT 3
145 DW (0E010H + 3) ;Pulse Main Battery Relay #n

144 0028' 60 + WAIT20 DB 60H ;Go to Sequencer Subroutine
145 0029' 0409' + DW W20
147 ;
148 ;
149 002B' E011 + BAT 1 ;TURN ON ALL SYSTEM BATTERIES
150 DW (0E010H + 1) ;Pulse Main Battery Relay #n
151 002D' E012 + BAT 2 DW (0E010H + 2) ;Pulse Main Battery Relay #n
152 002F' E013 + BAT 3 DW (0E010H + 3) ;Pulse Main Battery Relay #n
155 ;
156 ;
157 0031' E0C0 + CAMERA DW 0E0C0H ;Take a Picture
159 ;
160 0033' E001 + SEND 1 ;SEND CODE "1" TO SIGNAL TRANSMISSOMETER TEST;
161 DW (3000H + 1) ;Push Pinger Code on ASTK
162 0035' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
163 ;
164 ;
165 0037' 60 + WAIT2M DB 60H ;Go to Sequencer Subroutine
166 0038' 043F' + DW W2M
168 ;
169 003A' 3000 + SEND 0 ;SEND PINGER CODE 0
170 DW (3000H + 0) ;Push Pinger Code on ASTK
171 003C' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
172 ;
173 ;
174 ;
175 ;
176 ; At this point we launch the instrument. The bottom sense switch
177 ; is NOT enabled for 20 Min. in order not to false trigger during launch.
178 ; The transmissometer is tested after the 20 min. wait to get a clear water
179 ; transmission sample.
180 ;
181 ;
182 003E' DIVE: PUSH 1,0AH ;REST FOR 08 Min. DURING LAUNCH
183 003E' 30 + DB (2FH + 1) ;Push Data on ASTK
184 003F' 0A + DB 0AH
185 0040' 82 + WAIT MIN DB 82H ;Wait for interval of Min on ASTK
186 TCHK1: SDON DW 0E051H ;Sea Data Recorder ON
187 0041' E051 + ADON DW 0E031H ;A/D ON
188 0043' E031 + TRON DW 0E041H ;Transmissometer ON
189 0045' E041 + ;
190 ;
191 ;
192 ;
193 ;
194 ;
195 ;
196 0047' ONBOT?: NOOP ;WAIT TILL WE ARE ON THE BOTTOM
197 0047' C4 + DB 0C4H ;No Operation
198 BRBOT ONBOT DW 0E0F0H ;Branch if Bottom Sw to
199 0048' E0F0 +

200 004A' 004F' + DW ONBOT ;Address
201 304C' 28 + JUMP ONBOT?
202 304D' 0047' + DB 28H ;Jump To PPC at
DW ONBOT? ;Address
204 ;
205 ;
206 ;*****
207 ;
208 ; We are on the bottom. We send signal 1 and then see if we are level.
209 ;
210 ;
211 004F' ONBOT: SEND 1 ;SEND PINGER CODE 1
212 004F' 3001 + DW (3000H + 1) ;Push Pinger Code on ASTK
213 0051' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
214 ;
215 0053' E031 + ADON ;TURN ON A/D AND RECORD
DW 0E031H ;A/D ON
216 0055' E051 + SDON
DW 0E051H ;Sea Data Recorder ON
219 TRON
DW 0E041H ;Transmissometer ON
220 0057' E041 +
221 ;
222 CAMERA ;TAKE A PICTURE
DW 0E0COH ;Take a Picture
224 WAIT20 ;WAIT 20 SEC TO GET TILTS RECORDED
225 005B' 60 + DB 60H ;Go to Sequencer Subroutine
226 005C' 0409' + DW W20
227 ;
228 005E' E070 + TLTIN: CHKTLT ;CHECK TILTS. SEND SIGNAL TO SURFACE (C=OK, D=BAD)
DW 0E070H ;Check Roll, Pitch; Send Signal
230 ;
231 ;
232 ;SET COUNTER "A" FOR DEFAULT CONTINUATION AT ROTATE
233 ;IF SURFACE COMMAND IN NOT RECEIVED IN 2 MIN.
234 SETCTA 078H, INSERT
235 0060' A1 + DB 0A1H
236 0061' 0078 + DW 078H ;Set Counter A (Hex Seconds)
237 0063' 0084' + DW INSERT ; Counter A Vector (When count = 0000
238 ;
239 ;
240 ;
241 0065' RPLY1?: BRCMD1 INSERT ;CMD "1" = GO TO INSERT
;CMD "1" = GO TO INSERT
242 0065' E0F8 + DW 0EOF8H ;Branch if XPONDRCMD. 1 Received to
243 0067' 0084' + DW INSERT ;Address
244 BRCMD2 LIFT1 ;CMD "2" = GO TO B
245 0069' E0F9 + DW 0EOF9H ;Branch if XPONDRCMD. 2 Received to
246 0068' 0070' + DW LIFT1 ;Address
247 JUMP RPLY1?
248 006D' 28 + DB 28H ;Jump To PPC at
249 006E' 0065' + DW RPLY1? ;Address
250 ;
251 ;
252 0070' LIFT1: INITC
253 0070' 4D + DB 4DH ;Clear stacks, modes, PPCCNT, Counters
SEND 9 ;HERE WE LIFT THE SEA DUCT AND MOVE TO A NEW POSITION
DW (3000H + 9) ;Push Pinger Code on ASTK
255 0071' 3009 +

MACRO-18 3.36
4KMR127 28 SEP 86

PAGE 1-6

256 0073' E024 + ;Send Pinger Code (on ASTK)
257 0075' + OFFBOT: NOOP
258 0075' C4 + DB 0C4H ;No Operation
259 + BRBOT OFFBOT
260 0076' EOF0 + DW 0EOF0H ;Branch if Bottom Sw to
261 0078' 0075' + DW OFFBOT ;Address
262 + SEND 8 ;SEND OFF BOTTOM SIGNAL
263 007A' 3008 + DW (3000H + 8) ;Push Pinger Code on ASTK
264 007C' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
265 + WAIT60
266 007E' 60 + DB 60H ;Go to Sequencer Subroutine
267 007F' 042D' + DW W60
268 + JUMP ONBOT? ;GO TO ONBOT?
269 0081' 28 + DB 28H ;Jump To PPC at
270 0082' 0047' + DW CM3CT? ;Address
271 :
272 :
273 :
274 :*****
275 :
276 : We are ready to insert the flume. Signal "3" is sent to the
277 : surface. Then the insertion attempt is made. When the four insertion
278 : sense switches are closed, Signal "3" is sent and insertion is stopped.
279 : If insertion is not achieved within 5 Min., the "insertion bad
280 : (Sig. "5")" is sent. We then wait for a surface reply. Surface
281 : command "1" will continue the program and go to the "RUN1" routine.
282 : Surface command "2" will continue insertion.
283 :
284 :
285 :
286 0084' + INSERT: INITC ;INITIALIZE - JUST IN CASE
287 0084' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
288 :
289 0085' E0DD + LDVRST
290 0085' E0DD + DW 0E0D0H ;Reset the LDV
291 :
292 : CAMERA
293 0087' E0C0 + DW 0E0C0H ;Take a Picture
294 + SEND 3 ;SEND SIGNAL "3" - START OF INSERTION
295 0089' 3003 + DW (3000H + 3) ;Push Pinger Code on ASTK
296 008B' 2024 + DW 0E024H ;Send Pinger Code (on ASTK)
297 :
298 : HYDRA ;START THE HYDRAULIC PUMP
299 008D' E0A8 + DW 0E0A8H ;Pulse Hydraulic Pump Relay
300 + FLUMIN ;START THE FLUME INSERTION
301 008F' E0AC + DW 0E0A8H ;Insert Flume
302 :
303 + SETCTA 01A4H, INBAD ;SET TIME OUT COUNTER FOR 7 MIN.
304 0091' A1 + DB 0A1H
305 0092' 01A4 + DW 01A4H ;Set Counter A (Hex Seconds)
306 0094' 00A9' + DW INBAD ; Counter A Vector (When count = ..)
307 :
308 0096' + IN?: BRIMS INOK ;WAIT FOR INSERTION SWITCHES TO CLOSE
309 0096' EOFI + DW 0EOF1H ;Branch if Flume inserted to
310 0098' 009D' + DW INOK ;Address
311 + JUMP IN?

312 009' 28 + DB 28H ;Jump To PPC at
313 009B' 0096' + DW IN? ;Address
314 ;
315 009D' INOK: CLRCTA ;CLEAR COUNTER A
316 009D' A0 + DB 0A0H ;Clear Counter A
317 ; FLUMIN ;STOP THE INSERTION
318 009E' EOAC + DW 0EOACH ;Insert Flume
319 ; HYDRA ;HYDRAULIC PUMP OFF
320 00A0' EOAB + DW 0EOA8H ;Pulse Hydraulic Pump Relay
321 ; SEND 4 ;SEND SIGNAL "4" (INSERTION OK)
322 00A2' 3004 + DW (3000H + 4) ;Push Pinger Code on ASTK
323 00A4' EO24 + DW 0E024H ;Send Pinger Code (on ASTK)
324 ; JUMP RUN1 ;GO TO "RUN1"
325 00A6' 28 + DB 28H ;Jump To PPC at
326 00A7' 00C5' + DW RUN1 ;Address
327 ;
328 ;
329 ;
330 00A9' INBAD: FLUMIN ;STOP THE INSERTION
331 00A9' EOAC + DW 0EOACH ;Insert Flume
332 ; BRINS INOK+3 ;JUST IN CASE
333 00AB' EOF1 + DW 0EOF1H ;Branch if Flume Inserted to
334 00AD' 00A0' + DW INOK+3 ;Address
335 ;
336 ; HYDRA ;STOP THE HYDRAULIC PUMP
337 00AF' EOAB - DW 0EOA8H ;Pulse Hydraulic Pump Relay
338 ; SEND 5 ;SEND SIGNAL "5" (INSERTION BAD)
339 00B1' 3005 - DW (3000H + 5) ;Push Pinger Code on ASTK
340 00B3' EO24 - DW 0E024H ;Send Pinger Code (on ASTK)
341 ;
342 ; SET COUNTER 'A' FOR DEFAULT CONTINUATION IF
343 ; SURFACE COMMAND IS NOT RECEIVED WITHIN 5 MIN.
344 ; SETCTA 012CH, RUN1
345 00B5' A1 - DB 0A1H
346 00B6' 012C - DW 012CH ;Set Counter A (Hex Seconds)
347 00B8' 00C5' + DW RUN1 ; Counter A Vector (When count = 0000)
348 ;
349 ; WAIT FOR SURFACE SIGNAL
350 00BA' RPLY3?: BRCMD1 RUN1 ; CMD "1" = GO TO RUN1
351 00BA' EOF8 - DW 0EOF8H ;Branch if XPONDR CND. 1 Received to
352 00BC' 00C5' + DW RUN1 ;Address
353 ; BRCMD2 INSERT ; CMD "2" = GO TO INSERT TO TRY AGAIN
354 00BE' EOF9 - DW 0EOF9H ;Branch if XPONDR CND. 2 Received to
355 00C0' 0084' + DW INSERT ;Address
356 ; JUMP RPLY3?
357 00C2' 28 + DB 28H ;Jump To PPC at
358 00C3' 00BA' + DW RPLY3? ;Address
359 ;
360 ;
361 ;
362 ;*****
363 ;
364 ; We are now ready to start the experiment.
365 ;
366 ;
367 00C5' RUN1: INITC ;INITIALIZE

4KMR127 28 SEP 86

368 00C5' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
 369 00C6' E031 + ADON ;A/D, TRANS, RECORDER ON
 370 DW 0E031H ;A/D ON
 371 TRON
 372 00C8' E041 + DW 0E041H ;Transmissometer ON
 373 SDON
 374 00CA' E051 + DW 0E051H ;Sea Data Recorder ON
 375 ;
 376 ;
 377 WAIT5M ;MEASURE ZERO VELOCITY FOR 5 MORE MIN.
 378 00CC' 60 + DB 60H ;Go to Sequencer Subroutine
 379 DW 05M
 380 ;
 381 CAMERA ;Take a Picture
 382 00CF' E0C0 + DW 0E0C0H
 383 ;
 384 PMPRLY ;TURN ON PLUME PUMP POWER
 385 00D1' E0AE + DW 0E0AEH ;Pulse Water Pump Power Relay
 386 ;
 387 PMP1 040H ;SET PUMP1 = 40H (35%)
 388 00D3' D2 + DB 0D2H ;Send Data On SAIL Loop 2
 389 DW ..0000 ;Data List Address
 390 00D6' 28 + DB 28H ;Jump To PPC at
 391 00D7' 00B5' + DW ..0001 ;Address
 392 00D9' 23 50 43 21 + ..0000: DB "#PC!PI"
 393 00DD' 50 31 +
 394 00DF' 30 34 30 48 + DB '040H'
 395 00E3' 20 + DB ..
 396 00E4' FF + DB DONE
 397 00E5' + ..0001: DB OFF
 398 00E5' D0 + DB 0DOH ;SAIL Loop 2 Power Off
 399 00E6' E061 + DW 0E061H ;Set PUMP1 on SPAGE = XI
 400 00E8' 40 + DB 040H
 401 ;
 402 GOSUB DATRUN ;DO A DATA SERIES
 403 00E9' 60 + DB 60H ;Go to Sequencer Subroutine
 404 00EA' 0300' + DW DATRUN
 405 ;DATRUN SUB. RETURNS WITH NO CHANGE IN X,Y,Z POSITION
 406 ;
 407 ;
 408 *****
 409 ;
 410 ; This marks the end of the first velocity measurement series.
 411 ; The second run is started.
 412 ;
 413 ;*****
 414 ;
 415 00EC' RUN2: INITC ;INITIALIZE
 416 00EC' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
 417 ;
 418 PMP1 073H ;SET PUMP1 = 73H (45%)
 419 00ED' D2 + DB 0D2H ;Send Data On SAIL Loop 2
 420 DW ..0002 ;Data List Address
 421 00F0' 28 + DB 28H ;Jump To PPC at
 422 00F1' 00FF' + DW ..0003 ;Address
 423 00F3' 23 50 43 21 + ..0002: DB "#PC!PI"

424 00F7' 50 31 +
425 00F9' 30 37 33 48 + DB '073E'
426 00FD' 20 + DB ''
427 00FE' FF + DB DONE
428 00FF' + ..0003: L2OFF
429 00FF' D0 + DB 0D0H ;SAIL Loop 2 Power Off
430 0100' E061 + DW 0E061H ;Set PUMP1 on GPAGE = N1
431 0102' 73 + DB 073H
432 ;
433 0103' 60 + GOSUB DATRUN ;DO A DATA SERIES
434 0104' 0300' + DB 60H ;Go to Sequencer Subroutine
435 0105' + DW DATRUN
436 ; ;DATRUN SUB. RETURNS WITH NO CHANGE IN X,Y,Z POSITION
437 ;
438 ;
439 ;*****
440 ;
441 ; This marks the end of the second velocity measurement series.
442 ; The third run is started.
443 ;
444 ;*****
445 ;
446 0106' + RUN3: INITC ;INITIALIZE
447 0106' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
448 ;
449 ; PUMP1 08DH ;SET PUMP1 = 8DH (55)
450 0107' 32 + DB 0D2H ;Send Data On SAIL Loop 2
451 0108' 010D' + DW ..0004 ;Data List Address
452 010A' 28 + DB 28H ;Jump To PPC at
453 010B' 0119' + DW ..0005 ;Address
454 010D' 23 50 43 21 + ..0004: DB "#PC!P1"
455 0111' 50 31 +
456 0113' 30 38 44 48 + DB '08DH'
457 0117' 20 + DB ''
458 0118' FF + DB DONE
459 0119' + ..0005: L2OFF
460 0119' D0 + DB 0D0H ;SAIL Loop 2 Power Off
461 011A' E061 + DW 0E061H ;Set PUMP1 on GPAGE = N1
462 011C' 8D + DB 08DH
463 ;
464 ; GOSUB DATRUN ;DO A DATA SERIES
465 011D' 60 + DB 60H ;Go to Sequencer Subroutine
466 011E' 0300' + DW DATRUN
467 ; ;DATRUN SUB. RETURNS WITH NO CHANGE IN X,Y,Z POSITION
468 ;
469 ;
470 ;*****
471 ;
472 ; This marks the end of the third velocity measurement series.
473 ; The fourth run is started.
474 ;
475 ;*****
476 ;
477 0120' + RUN4: INITC ;INITIALIZE
478 0120' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
479 ;

480 PMP1 040H ;SET PUMP2 = 40H (25%)
481 0121' D2 + DB 0D2H ;Send Data On SAIL Loop 2
482 0122' 0127' + DW ..0006 ;Data List Address
483 0124' 28 + DB 28H ;Jump To PPC at
484 0125' 0133' + DW ..0007 ;Address
485 0127' 23 50 43 21 + ..0006: DB "#PC!P1"
486 0128' 50 31 +
487 012D' 30 34 30 48 + DB '040H'
488 0131' 20 + DB ''
489 0132' FF + DB DONE
490 0133' + ..0007: L2OFF
491 0133' D0 + DB 0D0H ;SAIL Loop 2 Power Off
492 0134' E061 + DW 0E061H ;Set PUMP1 on GPAGE = N1
493 0136' 40 + DB 040H
494 GOSUB DRUNY ;DO A DATA SERIES
495 0137' 60 + DB 60H ;Go to Sequencer Subroutine
496 0138' 0368' + DW DRUNY
497 ; ;DATRUN SUB. RETURNS WITH CHANGE IN Y POSITION
498 ;
499 ;
500 ;*****
501 ;
502 ; This marks the end of the last velocity measurement series.
503 ;
504 ;*****
505 ;
506 INITC ;INITIALIZE
507 013A' 4D + DB 4DH ;Clear stacks, modes, PPCCNT, Counters
508 PMPOFF ;TURN OFF BOTH PUMPS
509 013B' D2 + DB 0D2H ;Send Data On SAIL Loop 2
510 013C' 0141' + DW ..0008 ;Data List Address
511 013E' 28 + DB 28H ;Jump To PPC at
512 013F' 0146' + DW ..0009 ;Address
513 0141' 23 50 43 58 + ..0008: DB "#PCX"
514 0145' FF + DB DONE
515 0146' + ..0009: L2OFF
516 0146' D0 + DB 0D0H ;SAIL Loop 2 Power Off
517 0147' E060 + DW 0E060H ;Set PUMP1,2 on GPAGE = 00
518 PMPRLY ;TURN OFF PUMP POWER RELAY
519 0149' E0A8 + DW 0E0A8H ;Pulse Water Pump Power Relay
520 ;
521 ;
522 ;*****
523 ;
524 ;
525 PUSH 1, 01EH ;WAIT 30 MIN
526 014B' 30 + DB (2FH + 1) ;Push Data on ASTK
527 014C' 1E + DB 01EH
528 WAITF MIN
529 014D' 82 + DB 82H ;Wait for interval of Min on ASTK
530 ;
531 CAMERA
532 014E' E0C0 + DW 0E0C0H ;Take a Picture
533 ;
534 ; Velocity data series is now done. We are ready to take both cores.
535 ;

536 :
537 SEND 6 ;SIGNAL START OF CORE
538 0150' 3006 + DW (300H + 6) ;Push Pinger Code on ASTK
539 0152' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
540 :
541 HYDRA ;START THE HYDRAULIC PUMP
542 0154' E0A8 + DW 0E0A8H ;Pulse Hydraulic Pump Relay
543 :
544 SEDINS 1 ;START SEDIMENT 1 INSERT
545 0156' E0A1 + DW 0E0A1H ;Insert Sediment Sampler #1
546 WAIT20
547 0158' 60 + DB 60H ;Go to Sequencer Subroutine
548 0159' 0409' + DW W20
549 WAIT30 ;WAIT 30 SEC
550 015B' 60 + DB 60H ;Go to Sequencer Subroutine
551 015C' 041B' + DW W30
552 SEDINS 1 ;STOP SEDIMENT 1 INSERT
553 015E' E0A1 + DW 0E0A1H ;Insert Sediment Sampler #1
554 :
555 SEDUNL 1 ;UNLATCH CLOSES THE CORE BOX AND TAKES A WATER SAMPLE
556 0160' E0A3 + DW 0E0A3H ;Unlatch Sed. Sampler #1, Sample H20-1
557 WAIT30 ;WAIT 30 TO LET HYDRAULIC PRES. BUILD
558 0162' 60 + DB 60H ;Go to Sequencer Subroutine
559 0163' 041B' + DW W30
560 SEDUNL 1 ;2nd UNLATCH TURNS OFF THE UNLATCH POWER
561 0165' E0A3 + DW 0E0A3H ;Unlatch Sed. Sampler #1, Sample H20-1
562 :
563 SEDRET 1 ;START SEDIMENT 1 RETRACT
564 0167' E0A2 + DW 0E0A2H ;Retract Sediment Sampler #1
565 WAIT20
566 0169' 60 + DB 60H ;Go to Sequencer Subroutine
567 016A' 0409' + DW W20
568 WAIT30 ;WAIT 30 SEC
569 016C' 60 + DB 60H ;Go to Sequencer Subroutine
570 016D' 041B' + DW W30
571 SEDRET 1 ;STOP SEDIMENT 1 RETRACT
572 016F' E0A2 + DW 0E0A2H ;Retract Sediment Sampler #1
573 :
574 :
575 :
576 SEDINS 2 ;START SEDIMENT 2 INSERT
577 0171' E0A5 + DW 0E0A5H ;Insert Sediment Sampler #2
578 WAIT20
579 0173' 60 + DB 60H ;Go to Sequencer Subroutine
580 0174' 0409' + DW W20
581 WAIT30 ;WAIT 30 SEC
582 0176' 60 + DB 60H ;Go to Sequencer Subroutine
583 0177' 041B' + DW W30
584 SEDINS 2 ;STOP SEDIMENT 2 INSERT
585 0179' E0A5 + DW 0E0A5H ;Insert Sediment Sampler #2
586 :
587 SEDUNL 2 ;UNLATCH CLOSES THE CORE BOX AND TAKES A WATER SAMPLE
588 017B' E0A7 + DW 0E0A7H ;Unlatch Sed. Sampler #2, Sample H20-2
589 WAIT30 ;WAIT 30 TO LET HYDRAULIC PRES. BUILD
590 017D' 60 + DB 60H ;Go to Sequencer Subroutine
591 017E' 041B' + DW W30

592 0180' EO1A7 + SEDUNL 2 ;2nd UNLATCH TURNS OFF THE UNLATCH POWER
593 DW 0EOA7H ;Unlatch Sed. Sampler #2, Sample H20-2
594 ;
595 0182' EO1A6 + SEDRET 2 ;START SEDIMENT 2 RETRACT
596 DW 0EOA6H ;Retract Sediment Sampler #2
597 ;
598 0184' 60 + WAIT20 DB 60H ;Go to Sequencer Subroutine
599 DW W20
600 0185' 0409' + WAIT30 ;WAIT 30 SEC
601 DW 60H ;Go to Sequencer Subroutine
602 0188' 041B' + DW W30
603 018A' EO1A6 + SEDRET 2 ;STOP SEDIMENT 2 RETRACT
604 DW 0EOA6H ;Retract Sediment Sampler #2
605 ;
606 018C' EO1A8 + HYDRA ;STOP THE HYDRAULIC PUMP
607 DW 0EOA8H ;Pulse Hydraulic Pump Relay
608 ;
609 ;
610 ;*****
611 ;
612 ; Move X near to Xo.
613 ;
614 018E' EO1A8 + HYDRA ;START THE HYDRAULIC PUMP
615 DW 0EOA8H ;Pulse Hydraulic Pump Relay
616 0190' EO1I + DW 0EO91H ;MOVE X-
617 ;
618 0192' 60 + WAIT30 DB 60H ;Go to Sequencer Subroutine
619 DW W30
620 0193' 041B' + WAIT10 DW W10
621 0195' 60 + DB 60H ;Go to Sequencer Subroutine
622 DW 0EO91H ;MOVE X-
623 0198' EO1I + HYDRA ;STOP THE HYDRAULIC PUMP
624 DW 0EOA8H ;Pulse Hydraulic Pump Relay
625 ;
626 ;
627 CAMERA DW 0EOC0H ;Take a Picture
628 019C' EO1C0 + ;
629 ;
630 ;
631 ; We are ready to retract the flume. Signal "3" is sent to the
632 ; surface. Then the retraction attempt is made. When the flume retracted
633 ; sense switch is closed, Signal "3" is sent and retraction is stopped.
634 ; If retraction is not achieved within 6 Min., the "retraction bad
635 ; (Sig. "5")" is sent. We then wait for a surface reply. CMD "1" will
636 ; direct the program to the "PINI" routine; CMD "2" will continue retraction.
637 ;
638 ;
639 ;
640 019E' RETRCT: INITC
641 019E' 4D + DB 4DR ;Clear stacks, modes, PPCCNT, Counters
642 ;SEND SIGNAL "3" - START OF RETRACTION
643 019F' 3003 + DW (3000H + 3) ;Push Pinger Code on ASTK
644 01A1' EO24 + DW 0EO24H ;Send Pinger Code (on ASTK)
645 ;
646 01A3' EO1A8 + HYDRA ;START THE HYDRAULIC PUMP
647 DW 0EOA8H ;Pulse Hydraulic Pump Relay
PLUMOUT ;RETRACT THE FLUME

648 01A5' EOAD + DW 0EOADH ;Retract Flume
649 + ;
650 SETCTA 01EOH, RETBAD ;SET TIME OUT COUNTER FOR 8 MIN.
651 01A7' A1 + DB 0A1H
652 01A8' 01E0 + DW 01EOH ;Set Counter A (Hex Seconds)
653 01AA' 01BF' + DW RETBAD ; Counter A Vector (When count = 0000)
654 + ;
655 01AC' RET?: BRRET RETOK DW 0EOF2H ;Branch if Flume Retracted to
656 01AC' EOF2 + DW RETOK ;Address
657 01AB' 01B3' + JUMP RET? DW 28H ;Jump To PPC at
658 + DW RET? ;Address
659 01B0' 28 + ;
660 01B1' 01AC' + ;
661 + ;
662 01B3' RETOK: CLRCTA ;CLEAR THE TIME OUT COUNTER
663 01B3' A0 + DB 0AOH ;Clear Counter A
664 + FLUMOUT ;STOP THE RETRACTION
665 01B4' EOAD + DW 0EOADH ;Retract Flume
666 + HYDRA ;STOP THE HYDRAULIC PUMP
667 01B6' EOAS + DW 0EOA8H ;Pulse Hydraulic Pump Relay
668 + SEND 4 ;SEND SIGNAL "4" - RETRACTION OK
669 01B8' 3004 + DW (3000H + 4) ;Push Pinger Code on ASTK
670 01BA' EO24 + DW 0E024H ;Send Pinger Code (on ASTK)
671 + JUMP SETTLE DW 28H ;Jump To PPC at
672 01BC' 28 + DW SETTLE ;Address
673 01BD' 01DB' + ;
674 + ;
675 + ;
676 01BF' RETBAD: FLUMOUT ;STOP THE RETRACTION
677 01BF' EOAD + DW 0EOADH ;Retract Flume
678 + BRRET RETOK+3 ;JUST IN CASE
679 01C1' EOF2 + DW 0EOF2H ;Branch if Flume Retracted to
680 01C3' 01B6' + DW RETOK+3 ;Address
681 + ;
682 + HYDRA ;STOP THE HYDRAULIC PUMP
683 01C5' EOAS + DW 0EOA8H ;Pulse Hydraulic Pump Relay
684 + SEND 5 ;SEND SIGNAL "5" (RETRACTION BAD)
685 01C7' 3005 + DW (3000H + 5) ;Push Pinger Code on ASTK
686 01C9' EO24 + DW 0E024H ;Send Pinger Code (on ASTK)
687 + ;
688 + ;SET COUNTER 'A' FOR DEFAULT CONTINUATION IF
689 + ;SURFACE COMMAND IS NOT RECEIVED WITHIN 6 MIN.
690 SETCTA 0168H, SETTLE
691 01CB' A1 + DB 0A1H
692 01CC' 0168 + DW 0168H ;Set Counter A (Hex Seconds)
693 01CE' 01DB' + DW SETTLE ; Counter A Vector (When count = 0000)
694 + ;
695 + ;
696 + ;WAIT FOR SURFACE SIGNAL
697 01D0' RPLY4?: BRCMD1 SETTLE ;CMD "1" = GO SETTLE
698 01D0' EOF8 + DW 0EOF8H ;Branch if XPONDR CMD. 1 Received to
699 01D2' 01DB' + DW SETTLE ;Address
700 + BRCMD2 RETRCT ;CMD "2" = GO TO RETRACT AGAIN
701 01D4' EOF9 + DW 0EOF9H ;Branch if XPONDR CMD. 2 Received to
702 01D6' 019E' + DW RETRCT ;Address
703 + JUMP RPLY4?

MACRO-18 3.36
4KMR127 28 SEP 86

PAGE 1-14

704 01D8' 28 + DB 28H ;Jump To PPC at
705 01D9' 01D0' + DW RPLY4? ;Address
706 ;
707 ;
708 ;
709 ;*****
710 ;
711 ; At this point the flume is retracted. Now we will wait 3 min. for
712 ;the water to clear.
713 ;
714 01DB' SETTLE: INITC
715 01DB' 4D + DB 4DH ;Clear stacks, modes, PPCCNT, Counters
716 ;CAMERA ;TAKE A PICTURE
717 01DC' E0C0 + DW 0E0COH ;Take a Picture
718 ;
719 ;WAIT59 ;WAIT FOR 1 MIN.
720 01DE' 60 + DB 60H ;Go to Sequencer Subroutine
721 01DF' 0424' + DW W59
722 ;CAMERA ;TAKE A PICTURE
723 01E1' E0C0 + DW 0E0COH ;Take a Picture
724 ;
725 ;WAIT59 ;WAIT FOR 1 MIN.
726 01E3' 60 + DB 60H ;Go to Sequencer Subroutine
727 01E4' 0424' + DW W59
728 ;CAMERA ;TAKE A PICTURE
729 01E6' E0C0 + DW 0E0COH ;Take a Picture
730 ;
731 ;WAIT59 ;WAIT FOR 1 MIN.
732 01E8' 60 + DB 60H ;Go to Sequencer Subroutine
733 01E9' 0424' + DW W59
734 ;CAMERA ;TAKE A PICTURE
735 01EB' E0C0 + DW 0E0COH ;Take a Picture
736 ;
737 ;
738 ;
739 ;*****
740 ;
741 ; Here we return to the surface. Haul it up.
742 ;
743 ;
744 01ED' FINI: INITC ;INITIALIZE JUST IN CASE
745 01ED' 4D + DB 4DH ;Clear stacks, modes, PPCCNT, Counters
746 ;SEND F ;SEND SIGNAL "F" - HAUL IT UP
747 01EE' 300F + DW (3000H + F) ;Push Pinger Code on ASTK
748 01FO' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
749 ;
750 ;
751 01F2' GOHOME: NOOP
752 01F2' C4 + DB 0C4H ;No Operation
753 ;BRBOT GOHOME
754 01F3' E0P0 + DW 0E0FOH ;Branch if Bottom Sw to
755 01F5' 01F2' + DW GOHOME ;Address
756 ;
757 ;
758 01F7' MOVING: SEND 8 + ;On the way up!
759 01F7' 3008 + DW (3000H + 8) ;Push Pinger Code on ASTK

MACRO-18 3.36
4KNR127 28 SEP 86

PAGE 1-15

760	01F9'	E024	+	DW 0E024H	;Send Pinger Code (on ASTK)
761				;	
762				*****	*****
763				;	
764				;	
765				;	
766				;	
767	01FB'			STOP: NOOP	;END OF DIVE IDLE LOOP
768	01FB'	C4	+	DB 0C4H	;No Operation
769				JUMP STOP	
770	01FC'	28	+	DB 28H	;Jump To PPC at
771	01FD'	01FB'	+	DW STOP	;Address
772				;	
773				;	
774				;	
775				;	
776				***** END OF SEQUENCER MAIN PROGRAM *****	
777				;	
778				PAGE	

779
780 ;***** Sequencer Subroutines *****
781 ;
782 01FF' CSEG
783 ORG (START + 0300H)
784 ;
785 ;***** DATA SERIES SUBROUTINE *****
786 ;
787 C INCLUDE ISDDAT7.MAC ;Include Sea Duct Data series subroutine
788 C ;
789 C ;***** DATA SERIES SUBROUTINE *****
790 C ;
791 C ;ISDDAT7.MAC 19 SEP 86
792 C ;
793 C ;
794 C ;
795 0300' C DATRUN: WAIT60 ;TAKE DATA WITH FLUME PUMP ON FOR 25 MIN.
796 0300' 60 C+ DB 60H ;Go to Sequencer Subroutine
797 0301' 042D' C+ DW W60
798 C WAIT59 ;2
799 0303' 60 C+ DB 60H ;Go to Sequencer Subroutine
800 0304' 0424' C+ DW W59
801 C CAMERA
802 0306' E0C0 C+ DW 0E0C0H ;Take a Picture
803 C ;
804 C WAIT60
805 0308' 60 C+ DB 60H ;Go to Sequencer Subroutine
806 0309' 042D' C+ DW W60
807 C WAIT59 ;4
808 030B' 60 C+ DB 60H ;Go to Sequencer Subroutine
809 030C' 0424' C+ DW W59
810 C CAMERA
811 030E' E0C0 C+ DW 0E0C0H ;Take a Picture
812 C ;
813 C WAIT60
814 0310' 60 C+ DB 60H ;Go to Sequencer Subroutine
815 0311' 042D' C+ DW W60
816 C WAIT59 ;6
817 0313' 60 C+ DB 60H ;Go to Sequencer Subroutine
818 0314' 0424' C+ DW W59
819 C CAMERA
820 0316' E0C0 C+ DW 0E0C0H ;Take a Picture
821 C ;
822 C WAIT60
823 0318' 60 C+ DB 60H ;Go to Sequencer Subroutine
824 0319' 042D' C+ DW W60
825 C WAIT59 ;8
826 031B' 60 C+ DB 60H ;Go to Sequencer Subroutine
827 031C' 0424' C+ DW W59
828 C CAMERA
829 031E' E0C0 C+ DW 0E0C0H ;Take a Picture
830 C ;
831 C WAIT60
832 0320' 60 C+ DB 60H ;Go to Sequencer Subroutine
833 0321' 042D' C+ DW W60

834		C	WAIT59	:10	
835	0323'	60	C+	DB 60H	;Go to Sequencer Subroutine
836	0324'	0424'	C+	DW W59	
837		C	CAMERA		
838	0326'	E0CO	C+	DW 0E0COH	;Take a Picture
839		C	;		
840		C	WAIT60		
841	0328'	60	C+	DB 60H	;Go to Sequencer Subroutine
842	0329'	042D'	C+	DW W60	
843		C	WAIT59	:12	
844	032B'	60	C+	DB 60H	;Go to Sequencer Subroutine
845	032C'	0424'	C+	DW W59	
846		C	CAMERA		
847	032E'	E0CO	C+	DW 0E0COH	;Take a Picture
848		C	;		
849		C	WAIT60		
850	0330'	60	C+	DB 60H	;Go to Sequencer Subroutine
851	0331'	042D'	C+	DW W60	
852		C	WAIT59	:14	
853	0333'	60	C+	DB 60H	;Go to Sequencer Subroutine
854	0334'	0424'	C+	DW W59	
855		C	CAMERA		
856	0336'	E0CO	C+	DW 0E0COH	;Take a Picture
857		C	;		
858		C	WAIT60		
859	0338'	60	C+	DB 60H	;Go to Sequencer Subroutine
860	0339'	042D'	C+	DW W60	
861		C	WAIT59	:16	
862	033B'	60	C+	DB 60H	;Go to Sequencer Subroutine
863	033C'	0424'	C+	DW W59	
864		C	CAMERA		
865	033E'	E0CO	C+	DW 0E0COH	;Take a Picture
866		C	;		
867		C	WAIT60		
868	0340'	60	C+	DB 60H	;Go to Sequencer Subroutine
869	0341'	042D'	C+	DW W60	
870		C	WAIT59	:18	
871	0343'	60	C+	DB 60H	;Go to Sequencer Subroutine
872	0344'	0424'	C+	DW W59	
873		C	CAMERA		
874	0346'	E0CO	C+	DW 0E0COH	;Take a Picture
875		C	;		
876		C	WAIT60		
877	0348'	60	C+	DB 60H	;Go to Sequencer Subroutine
878	0349'	042D'	C+	DW W60	
879		C	WAIT59	:20d	
880	034B'	60	C+	DB 60H	;Go to Sequencer Subroutine
881	034C'	0424'	C+	DW W59	
882		C	CAMERA		
883	034E'	E0CO	C+	DW 0E0COH	;Take a Picture
884		C	;		
885		C	WAIT60		
886	0350'	60	C+	DB 60H	;Go to Sequencer Subroutine
887	0351'	042D'	C+	DW W60	
888		C	WAIT59	:22	
889	0353'	60	C+	DB 60H	;Go to Sequencer Subroutine

890 0354' 0424' C+ DW W59
891 C
892 0356' E0C0 C+ CAMERA DW 0E0C0H ;Take a Picture
893 C ;
894 C WAIT60
895 0358' 60 C+ DB 60H ;Go to Sequencer Subroutine
896 0359' 042D' C+ DW W60
897 C WAIT59 ;24d Min.
898 0358' 60 C+ DB 60H ;Go to Sequencer Subroutine
899 035C' 0424' C+ DW W59
900 C CAMERA
901 0358' E0C0 C+ DW 0E0C0H ;Take a Picture
902 C ;
903 C WAIT30 ;25 Min.
904 0360' 60 C+ DB 60H ;Go to Sequencer Subroutine
905 0361' 041B' C+ DW W30
906 C ;
907 C SEND 7 ;SEND SIG. 7 END OF VELOCITY RUN
908 0363' 3007 C+ DW (3000H + 7) ;Push Pinger Code on ASTK
909 0365' E024 C+ DW 0E024H ;Send Pinger Code (on ASTK)
910 C ;
911 C RETURN
912 0367' 58 C+ DB 58H ;Return from Sequencer Subroutine
913 C ;
914 C ;
915 C ;*****
916 C ;
917 C ;
918 0368' DRUNY: WAIT60
919 0368' 60 + DB 60H ;Go to Sequencer Subroutine
920 0369' 042D' + DW W60
921 C WAIT59
922 036B' 60 + DB 60H ;Go to Sequencer Subroutine
923 036C' 0424' + DW W59
924 C CAMERA
925 036E' E0C0 + DW 0E0C0H ;Take a Picture
926 C ;2
927 C WAIT60
928 0370' 60 + DB 60H ;Go to Sequencer Subroutine
929 0371' 042D' + DW W60
930 C WAIT59
931 0373' 60 + DB 60H ;Go to Sequencer Subroutine
932 0374' 0424' + DW W59
933 C CAMERA
934 0376' E0C0 + DW 0E0C0H ;Take a Picture
935 C ;4
936 C WAIT60
937 0378' 60 + DB 60H ;Go to Sequencer Subroutine
938 0379' 042D' + DW W60
939 C WAIT59
940 037B' 60 + DB 60H ;Go to Sequencer Subroutine
941 037C' 0424' + DW W59
942 C CAMERA
943 037E' E0C0 + DW 0E0C0H ;Take a Picture
944 C ;6
945 C WAIT60

MACRO-18 3.36
4XNR127 28 SEP 86

PAGE 1-19

946	0380'	60	+		DB 60H	;Go to Sequencer Subroutine
947	0381'	042D'	+		DW W60	
948				WAIT59		
949	0383'	60	+		DB 60H	;Go to Sequencer Subroutine
950	0384'	0424'	+		DW W59	
951				CAMERA		
952	0386'	E0C0	+		DW 0E0C0H	;Take a Picture
953				;8		
954				HYDRA	;MOVE TO Y ZERO	
955	0388'	E0A8	+		DW 0E0A8H	;Pulse Hydraulic Pump Relay
956	038A'	E093			DW 0E093H	
957				WAIT20		
958	038C'	60	+		DB 60H	;Go to Sequencer Subroutine
959	038D'	0409'	+		DW W20	
960	038F'	E093			DW 0E093H	
961				HYDRA		
962	0391'	E0A8	+		DW 0E0A8H	;Pulse Hydraulic Pump Relay
963				;		
964				WAIT60		
965	0393'	60	+		DB 60H	;Go to Sequencer Subroutine
966	0394'	042D'	+		DW W60	
967				WAIT59		
968	0396'	60	+		DB 60H	;Go to Sequencer Subroutine
969	0397'	0424'	+		DW W59	
970				CAMERA		
971	0399'	E0C0	+		DW 0E0C0H	;Take a Picture
972				;2		
973				WAIT60		
974	039B'	60	+		DB 60H	;Go to Sequencer Subroutine
975	039C'	042D'	+		DW W60	
976				WAIT59		
977	039E'	60	+		DB 60H	;Go to Sequencer Subroutine
978	039F'	0424'	+		DW W59	
979				CAMERA		
980	03A1'	E0C0	+		DW 0E0C0H	;Take a Picture
981				;4		
982				WAIT60		
983	03A3'	60	+		DB 60H	;Go to Sequencer Subroutine
984	03A4'	042D'	+		DW W60	
985				WAIT59		
986	03A6'	60	+		DB 60H	;Go to Sequencer Subroutine
987	03A7'	0424'	+		DW W59	
988				CAMERA		
989	03A9'	E0C0	+		DW 0E0C0H	;Take a Picture
990				;6		
991				WAIT60		
992	03AB'	60	+		DB 60H	;Go to Sequencer Subroutine
993	03AC'	042D'	+		DW W60	
994				WAIT59		
995	03AB'	60	+		DB 60H	;Go to Sequencer Subroutine
996	03AP'	0424'	+		DW W59	
997				CAMERA		
998	03B1'	E0C0	+		DW 0E0C0H	;Take a Picture
999				;8		
1000	03B3'	E0A8	+		HYDRA	;MOVE TO Y3
1001					DW 0E0A8H	;Pulse Hydraulic Pump Relay

MACRO-18 3.36
4KMR127 28 SEP 86

PAGE 1-20

1002	03B5'	E092		DW 0E092H	
1003				WAIT20	
1004	03B7'	60	+		DB 60H ;Go to Sequencer Subroutine
1005	03B8'	0409'	+		DW W20
1006	03BA'	E092		DW 0E092H	
1007				HYDRA	
1008	03BC'	E0A8	+		DW 0E0A8H ;Pulse Hydraulic Pump Relay
1009			;		
1010				WAIT60	
1011	03BE'	60	+		DB 60H ;Go to Sequencer Subroutine
1012	03BF'	042D'	+		DW W60
1013				WAIT59	
1014	03C1'	60	+		DB 60H ;Go to Sequencer Subroutine
1015	03C2'	0424'	+		DW W59
1016				CAMERA	
1017	03C4'	E0C0	+		DW 0E0C0H ;Take a Picture
1018			;		
1019				WAIT60	
1020	03C6'	60	+		DB 60H ;Go to Sequencer Subroutine
1021	03C7'	042D'	+		DW W60
1022				WAIT59	
1023	03C9'	60	+		DB 60H ;Go to Sequencer Subroutine
1024	03CA'	0424'	+		DW W59
1025				CAMERA	
1026	03CC'	E0C0	+		DW 0E0C0H ;Take a Picture
1027			;		
1028				WAIT60	
1029	03CE'	60	+		DB 60H ;Go to Sequencer Subroutine
1030	03CF'	042D'	+		DW W60
1031				WAIT59	
1032	03D1'	60	+		DB 60H ;Go to Sequencer Subroutine
1033	03D2'	0424'	+		DW W59
1034				CAMERA	
1035	03D4'	E0C0	+		DW 0E0C0H ;Take a Picture
1036			;		
1037				WAIT60	
1038	03D6'	60	+		DB 60H ;Go to Sequencer Subroutine
1039	03D7'	042D'	+		DW W60
1040				WAIT59	
1041	03D9'	60	+		DB 60H ;Go to Sequencer Subroutine
1042	03DA'	0424'	+		DW W59
1043				CAMERA	
1044	03DC'	E0C0	+		DW 0E0C0H ;Take a Picture
1045			;		
1046			;		
1047				RETURN	
1048	03DE'	58	+		DB 58H ;Return from Sequencer Subroutine
1049			;		
1050			;		
1051			;		
1052			PAGE		

```
1053
1054
1055 ;***** SEQUENCER MACRO SUBROUTINES *****
1056 ;
1057 03DF' CSEG
1058 ORG (START + 0400H)
1059 ;
1060 C INCLUDE ISDSUB.MAC ;Include Sea Duct Macro Subroutines
1061 C
1062 C ;***** SEQUENCER MACRO SUBROUTINES *****
1063 C ;
1064 C : SEQUENCER MACRO SUBROUTINES
1065 C ;
1066 C : SUBTTL ISDSUB 15 JUL 86
1067 C ;
1068 C : This file must be included at the end of a Sequencer Macro Program
1069 C : Use "INCLUDE ISDSUB.MAC"
1070 C ;
1071 C ;***** SEQUENCER MACRO SUBROUTINES *****
1072 C ;
1073 0400' C CSEG : Change to Code Segment
1074 C ;
1075 C : Note: W10 - W60 allow for the call and return times.
1076 C : ie. W10 is set for 8 sec.
1077 C ;
1078 0400' C W10: SETCTC 0008, $+5 ;Wait for 10 Sec.
1079 0400' C+ DB 0C1H
1080 0401' C+ DW 0008 ;Set Counter C (Hex Seconds)
1081 0403' C+ DW $+5 ;Counter C Vector (When count = 0000)
1082 C JUMP $-1
1083 0405' C+ DB 03H ;Jump To PPC at
1084 0406' C+ DW $-1 ;Address
1085 C RETURN
1086 0408' C+ DB 58H ;Return from Sequencer Subroutine
1087 C ;
1088 C ;
1089 0409' C W20: SETCTC 0012, $+5 ;Wait for 20 Sec.
1090 0409' C+ DB 0C1H
1091 040A' C+ DW 0012 ;Set Counter C (Hex Seconds)
1092 040C' C+ DW $+5 ;Counter C Vector (When count = 0000)
1093 C JUMP $-1
1094 040E' C+ DB 28H ;Jump To PPC at
1095 040F' C+ DW $-1 ;Address
1096 C RETURN
1097 0411' C+ DB 58H ;Return from Sequencer Subroutine
1098 C ;
1099 C ;
1100 0412' C W29: SETCTC 001B, $+5 ;Wait for 29 Sec.
1101 0412' C+ DB 0C1H
1102 0413' C+ DW 001B ;Set Counter C (Hex Seconds)
1103 0415' C+ DW $+5 ;Counter C Vector (When count = 0000)
1104 C JUMP $-1
1105 0417' C+ DB 28H ;Jump To PPC at
1106 0418' C+ DW $-1 ;Address
1107 C RETURN
```

MACRO-18 3.36
ISDSUB 15 JUL 86

PAGE 1-22

1108	041A'	58	C+		DB 58H	;Return from Sequencer Subroutine
1109			C	;		
1110			C	;		
1111	041B'		C	W30: SETCTC 001C, \$+5		;Wait for 30 Sec.
1112	041B' C1		C+		DB 0C1H	
1113	041C' 001C		C+		DW 001C	;Set Counter C (Hex Seconds)
1114	041E' 0423'		C+		DW \$+5	;Counter C Vector (When count = 0000).
1115			C	JUMP \$-1		
1116	0420' 28		C+		DB 28H	;Jump To PPC at
1117	0421' 0420'		C+		DW \$-1	;Address
1118			C	RETURN		
1119	0423' 58		C+		DB 58H	;Return from Sequencer Subroutine
1120			C	;		
1121			C	;		
1122	0424'		C	W59: SETCTC 0039, \$+5		;Wait for 59 Sec.
1123	0424' C1		C+		DB 0C1H	
1124	0425' 0039		C+		DW 0039	;Set Counter C (Hex Seconds)
1125	0427' 042C'		C+		DW \$+5	;Counter C Vector (When count = 0000).
1126			C	JUMP \$-1		
1127	0429' 28		C+		DB 28H	;Jump To PPC at
1128	042A' 0429'		C+		DW \$-1	;Address
1129			C	RETURN		
1130	042C' 58		C+		DB 58H	;Return from Sequencer Subroutine
1131			C	;		
1132			C	;		
1133	042D'		C	W60: SETCTC 003A, \$+5		;Wait for 60 Sec.
1134	042D' C1		C+		DB 0C1H	
1135	042E' 003A		C+		DW 003A	;Set Counter C (Hex Seconds)
1136	0430' 0435'		C+		DW \$+5	;Counter C Vector (When count = 0000).
1137			C	JUMP \$-1		
1138	0432' 28		C+		DB 28H	;Jump To PPC at
1139	0433' 0432'		C+		DW \$-1	;Address
1140			C	RETURN		
1141	0435' 58		C+		DB 58H	;Return from Sequencer Subroutine
1142			C	;		
1143			C	;		
1144			C	;		
1145	0436'		C	W1M: SETCTC 003A, \$+5		;Wait for 1 MIN.
1146	0436' C1		C+		DB 0C1H	
1147	0437' 003A		C+		DW 003A	;Set Counter C (Hex Seconds)
1148	0439' 043E'		C+		DW \$+5	;Counter C Vector (When count = 0000).
1149			C	JUMP \$-1		
1150	043B' 28		C+		DB 28H	;Jump To PPC at
1151	043C' 043B'		C+		DW \$-1	;Address
1152			C	RETURN		
1153	043E' 58		C+		DB 58H	;Return from Sequencer Subroutine
1154			C	;		
1155			C	;		
1156	043F'		C	W2M: SETCTC 0076, \$+5		;Wait for 2 MIN.
1157	043F' C1		C+		DB 0C1H	
1158	0440' 0076		C+		DW 0076	;Set Counter C (Hex Seconds)
1159	0442' 0447'		C+		DW \$+5	;Counter C Vector (When count = 0000).
1160			C	JUMP \$-1		
1161	0444' 28		C+		DB 28H	;Jump To PPC at
1162	0445' 0444'		C+		DW \$-1	;Address
1163			C	RETURN		

1164	0447'	58	C+		DB 58H	;Return from Sequencer Subroutine
1165			C	;		
1166			C	;		
1167	0448'		C	W5M:	SETCTC 012A, \$+5	;Wait for 5 MIN.
1168	0448'	C1	C+		DB 0C1H	
1169	0449'	012A	C+		DW 012A	;Set Counter C (Hex Seconds)
1170	044B'	0450'	C+		DW \$+5	; Counter C Vector (When count = 0000)
1171			C	JUMP \$-1		
1172	044D'	28	C+		DB 28H	;Jump To PPC at
1173	044E'	044D'	C+		DW \$-1	;Address
1174			C	RETURN		
1175	0450'	58	C+		DB 58H	;Return from Sequencer Subroutine
1176			C	;		
1177			C	;		
1178	0451'		C	W7M:	SETCTC 01A2, \$+5	;Wait for 7 MIN.
1179	0451'	C1	C+		DB 0C1H	
1180	0452'	01A2	C+		DW 01A2	;Set Counter C (Hex Seconds)
1181	0454'	0459'	C+		DW \$+5	; Counter C Vector (When count = 0000)
1182			C	JUMP \$-1		
1183	0456'	28	C+		DB 28H	;Jump To PPC at
1184	0457'	0456'	C+		DW \$-1	;Address
1185			C	RETURN		
1186	0459'	58	C+		DB 58H	;Return from Sequencer Subroutine
1187			C	;		
1188			C	;		
1189			C	;		
1190			C	***** END OF SUBROUTINE INCLUDE FILE - ISDSUB *****		
1191			C	;		
1192			C	*****		
1193			C	;		
1194			C	;		
1195				;		
1196				*****		
1197				;		
1198				***** END OF SEQUENCER PSUEDO PROGRAM *****		
1199				;		
1200				END		

MACRO-18 3.36
ISDSUB 15 JUL 86

PAGE S

MACROS:

ADOFF	ADOM	BAT	BRBOT	BRCMD1	BRCMD2	BRCMD3	BRINS
BRRET	CAMERA	CHKTLT	CLRABC	CLRCTA	CLRCTB	CLRCTC	FLUMIN
FLUMOU	GOSUB	HYDRA	INCX	INCY	INCZ	INITC	INITS
JUMP	L2OFF	L2ON	L2SEND	LDVRST	NOOP	PING	PMP1
PMP2	PMPOFF	PMPRLY	POP	PUSH	RETURN	ROTCCW	ROTCW
ROTHDG	ROTRTN	SDOFF	SDOW	SEDINS	SEDRET	SEDUNL	SEND
SETCTA	SETCTB	SETCTC	SPMPO	SPMP1	SPMP2	TROFF	TRON
WAIT10	WAIT1M	WAIT20	WAIT29	WAIT2M	WAIT30	WAIT59	WAIT5M
WAIT60	WAIT7M	WAITF	WAITT	XYZO	ZEROX	ZEROY	ZEROZ

SYMBOLS:

..0000	00D9'	..0001	00E5'	..0002	00F3'	..0003	00FF'
..0004	010D'	..0005	0119'	..0006	0127'	..0007	0133'
..0008	0141'	..0009	0146'	A	000A	B	000B
C	000C	D	000D	DATRUN	0300'	DAYS	0001
DIVE	003E'	DONE	00FF	DRUNY	0368'	E	000E
F	000F	FINI	01ED'	GOHOME	01F2'	HOURS	0002
HRS	0002	IN?	0096'	INBAD	00A9'	INOK	009D'
INSERT	0084'	LIFT1	0070'	MIN	0003	MOVING	01F7'
OFFBOT	0075'	ONBOT	004F'	ONBOT?	0047'	RET?	01AC'
RETBAD	01BF'	RETOK	01B3'	RETRCT	019E'	RPLY1?	0065'
RPLY3?	00BA'	RPLY4?	01D0'	RUM1	00C5'	RUN2	00EC'
RUM3	0106'	RUM4	0120'	SEC	0004	SETTLE	01DB'
START	0000'	STOP	01FB'	TCHK1	0041'	TLTIN	005E'
W10	0400'	W1M	0436'	W20	0409'	W29	0412'
W2M	043F'	W30	041B'	W59	0424'	W5M	0448'
W60	042D'	W7M	0451'				

NO FATAL ERROR(S)

..0000	389	392\$										
..0001	391	397\$										
..0002	420	423\$										
..0003	422	428\$										
..0004	451	454\$										
..0005	453	459\$										
..0006	482	485\$										
..J007	484	490\$										
..0008	510	513\$										
..0009	512	515\$										
A	54\$											
ADOFF	54\$											
ADON	54\$	99	190	215	369							
B	54\$											
BAT	54\$	113	118	125	130	137	142	149	151	153		
BRBOT	54\$	198	259	753								
BRCMD1	54\$	241	350	697								
BRCMD2	54\$	244	353	700								
BRCMD3	54\$											
BRINS	54\$	308	332									
BRRZT	54\$	655	678									
C	54\$											
CAMERA	54\$	109	157	222	292	381	531	627	716	722	728	734
	801	810	819	828	837	846	855	864	873	882	891	900
	924	933	942	951	970	979	988	997	1016	1025	1034	1043
CHKTLT	54\$	228										
CLRABC	54\$											
CLRCTA	54\$	315	662									
CLRCTB	54\$											
CLRCTC	54\$											
D	54\$											
DATRUN	404	435	466	795\$								
DAYS	54\$	186	529									
DIVE	182\$											
DONE	54\$	396	427	458	489	514						
DRUNY	496	918\$										
E	54\$											
F	54\$	747	747	747								
FINI	744\$											
FLUMIN	54\$	300	317	330								
FLUMOU	54\$	647	664	676								
GOHOME	751\$	755										
GOSUB	54\$	116	121	128	133	140	145	166	225	266	378	402
	433	464	494	547	550	558	566	569	579	582	590	598
	601	618	621	720	726	732	796	799	805	808	814	817
	823	826	832	835	841	844	850	853	859	862	868	871
	877	880	886	889	895	898	904	919	922	928	931	937
	940	946	949	958	965	968	974	977	983	986	992	995


```
;      SEA DUCT SEQUENCER PPC MACROS
;
;      ISDSEQ.MAC      15 JUL 1986
;
;      W. E. TERRY
;
;      (Listing Supressed)
.XLIST
;
;      PREVIOUS VERS. 16 JUN 1986
;      PREVIOUS VERS. 26 MAR 1986
;      PREVIOUS VERS. 25 MAR 1986
;      PREVIOUS VERS. 11 DEC 1985
;      PREVIOUS VERS. 21 NOV 1985
;
;      Earlier versions exist.
;
;
;***** USED ONLY FOR ASSEMBLY OF SEQUENCER PSUEDO PROGRAM CODES *****
;
;      USE "INCLUDE ISDSEQ.MAC" IN SEQUENCER SOURCE
;
;
;***** BASIC FUNCTIONS *****
;
;
JUMP    MACRO P1
        DB 28H      ;Jump To PPC at
        DW P1      ;Address
ENDM
;
;
PUSH    MACRO P0,P1,P2,P3,P4
        DB (2FH + P0) ;Push Data on ASTK
        IF P0 EQ 1
                DB P1
        ELSE
                IF P0 EQ 2
                        DB P1
                        DB P2
                ELSE
                        IF P0 EQ 3
                                DB P1
                                DB P2
                                DB P3
                        ELSE
                                IF P0 EQ 4
                                        DB P1
                                        DB P2
                                        DB P3
                                ELSE
                                        DB P4
                                ELSE
                                        DB FQ  ;***** PUSH PARAMETER ERROR *****!!!!!!
```

```

        ENDIF
        ENDIF
        ENDIF
        ENDIF
ENDM

;
;

POP    MACRO P0
        DB (3FH + P0) ;Pop data from ASTK
        IF (P0 GT 4) OR (P0 LT 1)
        DB F0 ;***** POP PARAMETER ERROR *****!!!!!!!!!!!
        ENDIF
ENDM

;
;

INITS   MACRO
        DB 4CH           ;Clear stacks, modes, PPCCNT
ENDM

;
;

INITC   MACRO
        DB 4DH           ;Clear stacks, modes, PPCCNT, Counters
ENDM

;
;

CLRABC  MACRO
        DB 4EH           ;Clear Counters A, B, C
ENDM

;
;

RETURN  MACRO
        DB 58H           ;Return from Sequencer Subroutine
ENDM

;
;

GOSUB   MACRO P1
        DB 60H           ;Go to Sequencer Subroutine
        DW P1
ENDM

;
;

NOOP    MACRO
        DB 0C4H          ;No Operation
ENDM

;
;

;***** RTC Macros *****
;

DAYS    EQU 01
HRS     EQU 02
HOURS   EQU HRS
MIN     EQU 03
SEC     EQU 04
;

WAITT   MACRO P1

```

```
IF P1 EQ DAYS  
    DB 70H      ;Wait Till Days = ASTK  
ELSE  
    IF P1 EQ HOURS  
        DB 71H      ;Wait Till Hours = ASTK  
    ELSE  
        IF P1 EQ MIN  
            DB 72H      ;Wait Till Min = ASTK  
        ELSE  
            IF P1 EQ SEC  
                DB 73H      ;Wait Till Sec = ASTK  
            ELSE  
                DB 0F0H ;**** WAIT TILL ERROR ****!!!!!!  
            ENDIF  
        ENDIF  
    ENDIF  
ENDIF  
ENDM  
;  
;  
WAITF MACRO P1  
IF P1 EQ DAYS  
    DB 80H      ;Wait for interval of Days on ASTK  
ELSE  
    IF P1 EQ HOURS  
        DB 81H      ;Wait for interval of Hours on ASTK  
    ELSE  
        IF P1 EQ MIN  
            DB 82H      ;Wait for interval of Min on ASTK  
        ELSE  
            DB 0F0H ;**** WAIT TILL ERROR ****!!!!!!  
        ENDIF  
    ENDIF  
ENDIF  
ENDM  
;  
;  
;***** Sequencer Counter Macros *****  
;  
;*** Note: see INITC (PPC = 4D)  
;           CLRABC (PPC = 4E) above for other clear counter instructions.  
;  
;  
CLRCTA MACRO  
    DB 0AOH      ;Clear Counter A  
ENDM  
;  
;  
CLRCTB MACRO  
    DB 0BOH      ;Clear Counter B  
ENDM  
;  
;  
CLRCTC MACRO  
    DB 0COH      ;Clear Counter C
```

```

        ENDM
;

SETCTA MACRO P0, P1
        DB 0A1H
        DW P0      ;Set Counter A (Hex Seconds)
        DW P1      ; Counter A Vector (When count = 0000)
        ENDM
;

SETCTB MACRO P0, P1
        DB 0B1H
        DW P0      ;Set Counter B (Hex Seconds)
        DW P1      ; Counter B Vector (When count = 0000)
        ENDM
;

SETCTC MACRO P0, P1
        DB 0C1H
        DW P0      ;Set Counter C (Hex Seconds)
        DW P1      ; Counter C Vector (When count = 0000)
        ENDM
;

;

;

;

;

***** SAIL Loop # 2 Macros *****

L2OFF MACRO
        DB 0D0H      ;SAIL Loop 2 Power Off
        ENDM
;

L2ON MACRO
        DB 0D1H      ;SAIL Loop 2 Power On
        ENDM
;

L2SEND MACRO P0
        DB 0D2H      ;Send Data On SAIL Loop 2
        DW P0      ;Data List Address
        ENDM
;

;

;

;

***** EXTENDED SEQUENCER FUNCTIONS ( EO PREFIX ) *****

;

;

BAT MACRO P0
    IF (P0 EQ 1) OR (P0 EQ 2) OR (P0 EQ 3)
        DW (0E010H + P0)      ;Pulse Main Battery Relay #n
    ELSE
        DW 0FFFFH ; *** Battery Relay Error ***!!!!!!
    ENDIF

```

```
        ENDM  
;  
;  
ADOFF MACRO           DW 0E030H ;A/D OFF  
        ENDM  
;  
;  
ADON  MACRO           DW 0E031H ;A/D ON  
        ENDM  
;  
;  
TROFF MACRO          DW 0E040H ;Transmissometer OFF  
        ENDM  
;  
;  
TRON  MACRO          DW 0E041H ;Transmissometer ON  
        ENDM  
;  
;  
SDOFF MACRO          DW 0E050H ;Sea Data Recorder OFF  
        ENDM  
;  
;  
SDON  MACRO          DW 0E051H ;Sea Data Recorder ON  
        ENDM  
;  
;  
SPMPO MACRO          DW 0E060H ;Set PUMP1,2 on GPAGE = 00  
        ENDM  
;  
;  
SPMP1 MACRO N1       DW 0E061H ;Set PUMP1 on GPAGE = N1  
                      DB N1  
        ENDM  
;  
;  
SPMP2 MACRO N1       DW 0E062H ;Set PUMP2 on GPAGE = N1  
                      DB N1  
        ENDM  
;  
;  
CHLTLP MACRO          DW 0E070H ;Check Roll, Pitch; Send Signal  
                      ; "C" = Ok, "D" = Bad  
                      ; (+/- TLIMIT Deg) (See Equate Table)  
        ENDM
```

```
;  
;  
;***** Rotation Macros *****  
;  
ROTCW MACRO DW 0E080H ;Pulse Rotate CW Relay  
ENDM  
;  
;  
ROTCCW MACRO DW 0E081 ;Pulse Rotate CCW Relay  
ENDM  
;  
;  
ROTRTN MACRO DW 0E082H ;Rotate Flume to Transport Position  
; Send Signal "B" if error  
ENDM  
;  
;  
ROTHDG MACRO DW 0E083H ;Rotate Flume to Experiment Position  
; Send Signal "3" if error  
ENDM  
;  
;  
;***** X Y Z Traverse Macros *****  
;  
ZEROX MACRO DW 0E09AH ;Zero X Position  
; Send Signal "A" if error  
ENDM  
;  
;  
INCX MACRO DW 0E09BH ;Increment X Position  
; Send Signal "A" if error  
ENDM  
;  
;  
ZEROY MACRO DW 0E09CH ;Zero Y Position  
; Send Signal "A" if error  
ENDM  
;  
;  
INCY MACRO DW 0E09DH ;Increment Y Position  
; Send Signal "A" if error  
ENDM  
;  
;  
ZEROZ MACRO DW 0E09EH ;Zero Z Position  
; Send Signal "A" if error
```

```
        ENDM
;
;
INCZ MACRO           DW 0E09FH      ;Increment Z Position
;                                ; Send Signal "A" if error
        ENDM
;
;
XYZO MACRO           HYDRA
;                                ZEROX
;                                ZEROY
;                                ZEROZ
;                                HYDRA
        ENDM
;
;
;***** Sampler Macros *****
;
;
SEDINS MACRO P0
    IF P0 EQ 1             DW 0E0A1H      ;Insert Sediment Sampler #1
    ELSE
        IF P0 EQ 2             DW 0E0A5H      ;Insert Sediment Sampler #2
        ELSE
            DW 0FFFFQ      ;***** SEDIMENT INSERT ERROR ****!
        ENDIF
    ENDIF
    ENDM
;
;
SEDRET MACRO P0
    IF P0 EQ 1             DW 0E0A2H      ;Retract Sediment Sampler #1
    ELSE
        IF P0 EQ 2             DW 0E0A6H      ;Retract Sediment Sampler #2
        ELSE
            DW 0FFFFQ      ;*** SEDIMENT RETRACT ERROR ***!
        ENDIF
    ENDIF
    ENDM
;
;
SEDUNL MACRO P0
    IF P0 EQ 1             DW 0E0A3H      ;Unlatch Sed. Sampler #1, Sample H20-1
    ELSE
        IF P0 EQ 2             DW 0E0A7H      ;Unlatch Sed. Sampler #2, Sample H20-2
        ELSE
            DW 0FFFFQ      ;*** SEDIMENT UNLATCH ERROR ***!
        ENDIF
    ENDIF
    ENDM
```

```
        ENDIF
    ENDIF
ENDM

;
;

;*****MACROS*****


HYDRA MACRO           DW 0E0A8H      ;Pulse Hydraulic Pump Relay
ENDM

;
;

FLUMIN MACRO          DW 0E0A8H      ;Insert Flume
ENDM

;
;

FLUMOUT MACRO         DW 0E0ADH     ;Retract Flume
ENDM

;
;

PMPRLY MACRO          DW 0E0A8H      ;Pulse Water Pump Power Relay
ENDM

;
;

;PUMPI MACRO           DW 0E0A8H      ;Pulse Water Pump #1 Relay
;ENDM

;
;

;PUMP2 MACRO           DW 0E0A8H      ;Pulse Water Pump #2 Relay
;ENDM

;
;

;DVVRST MACRO          DW 0E0D0H      ;Reset the LDV
ENDM

;
;

CAMERA MACRO          DW 0E0C0H      ;Take a Picture
ENDM

;
;

;*****Pump Control Macros *****

;
;

DONE EQU 0FFH
;

;

PNPOFF MACRO
LOCAL D,J
L2SEND D
```

```
JUMP J
D: DB "#PCX"
DB DONE
J: L2OFF
SPMPO
ENDM
;
;
PMP1 MACRO A
LOCAL D,J
L2SEND D
JUMP J
D: DB "#PC!P1"
DB '6A'
DB ''
DB DONE
J: L2OFF
SPMPL A
ENDM
;
;
PMP2 MACRO A
LOCAL D,J
L2SEND D
JUMP J
D: DB "#PC!P2"
DB '6A'
DB ''
DB DONE
J: L2OFF
SPMPL A
ENDM
;
;
;
;
***** "Branch" Macros *****
;
BRBOT MACRO P0
DW 0EOF0H ;Branch if Bottom Sw to
DW P0 ;Address
ENDM
;
;
BRINS MACRO P0
DW 0EOF1H ;Branch if Flume Inserted to
DW P0 ;Address
ENDM
;
;
BRRET MACRO P0
DW 0EOF2H ;Branch if Flume Retracted to
DW P0 ;Address
ENDM
;
```

```

;
; BRCMD1 MACRO P0
; DW 0E0F8H      ;Branch if XPONDR CMD. 1 Received to
; DW P0          ;Address
ENDM
;

;
; BRCMD2 MACRO P0
; DW 0E0F9H      ;Branch if XPONDR CMD. 2 Received to
; DW P0          ;Address
ENDM
;

;
; BRCMD3 MACRO P0
; DW 0E0FAH      ;Branch if XPONDR CMD. 3 Received to
; DW P0          ;Address
ENDM
;

;
;

;
***** COMBINED FUNCTION MACROS *****

;
;

***** SEND ACOUSTIC CODE - MACRO *****

;
A EQU 0AH
B EQU 0BH
C EQU 0CH
D EQU 0DH
E EQU 0EH
F EQU 0FH
;

;
PING MACRO
DW 0E024H      ;Send Pinger Code (on ASTK)
ENDM
;

;
SEND MACRO P0
IF (P0 GT 0FH) OR (P0 LT 0)
DB FQ ;***** PINGER CODE ERROR *****
ELSE
DW (3000H + P0) ;Push Pinger Code on ASTK
ENDIF
PING
ENDM
;

;
***** SPECIFIC "WAIT FOR" MACROS *****

;
; ***** Wait for 10 Sec. *****
;

WAIT10 MACRO

```

```
GOSUB W10      ; Wait for 10 Sec.  
ENDM  
;  
; ***** Wait for 20 Sec. *****  
;  
WAIT20 MACRO      GOSUB W20      ; Wait for 20 Sec.  
ENDM  
;  
;  
; ***** Wait for 29 Sec. *****  
;  
WAIT29 MACRO      GOSUB W29      ; Wait for 29 Sec.  
ENDM  
;  
;  
; ***** Wait for 30 Sec. *****  
;  
WAIT30 MACRO      GOSUB W30      ; Wait for 30 Sec.  
ENDM  
;  
;  
; ***** Wait for 59 Sec. *****  
;  
WAIT59 MACRO      GOSUB W59      ; Wait for 59 Sec.  
ENDM  
;  
;  
; ***** Wait for 60 Sec. *****  
;  
WAIT60 MACRO      GOSUB W60      ; Wait for 60 Sec.  
ENDM  
;  
;  
;  
; ***** Wait for 1 Min. *****  
;  
WAIT1M MACRO      GOSUB W1M      ; Wait for 1 Min.  
ENDM  
;  
;  
; ***** Wait for 2 Min. *****  
;  
WAIT2M MACRO      GOSUB W2M      ; Wait for 2 Min.  
ENDM  
;  
;  
; ***** Wait for 5 Min. *****
```

```
; WAIT5M MACRO           GOSUB W5M      ; Wait for 5 Min.  
ENDM  
;  
; ***** Wait for 7 Min. *****  
;  
; WAIT7M MACRO           GOSUB W7M      ; Wait for 7 Min.  
ENDM  
;  
;  
;  
.LIST
```

```
;***** DATA SERIES SUBROUTINE *****  
;  
;ISDDAT7.MAC 19 SEP 86  
;  
;  
DATRUN: WAIT60      ;TAKE DATA WITH FLUME PUMP ON FOR 25 MIN.  
    WAIT59      :2  
    CAMERA  
;  
    WAIT60      :4  
    WAIT59      :4  
    CAMERA  
;  
    WAIT60      :6  
    WAIT59      :6  
    CAMERA  
;  
    WAIT60      :8  
    WAIT59      :8  
    CAMERA  
;  
    WAIT60      :10  
    WAIT59      :10  
    CAMERA  
;  
    WAIT60      :12  
    WAIT59      :12  
    CAMERA  
;  
    WAIT60      :14  
    WAIT59      :14  
    CAMERA  
;  
    WAIT60      :16  
    WAIT59      :16  
    CAMERA  
;  
    WAIT60      :18  
    WAIT59      :18  
    CAMERA  
;  
    WAIT60      :20d  
    WAIT59      :20d  
    CAMERA  
;  
    WAIT60      :22  
    WAIT59      :22  
    CAMERA  
;  
    WAIT60      :24d Min.  
    WAIT59      :24d Min.  
    CAMERA
```

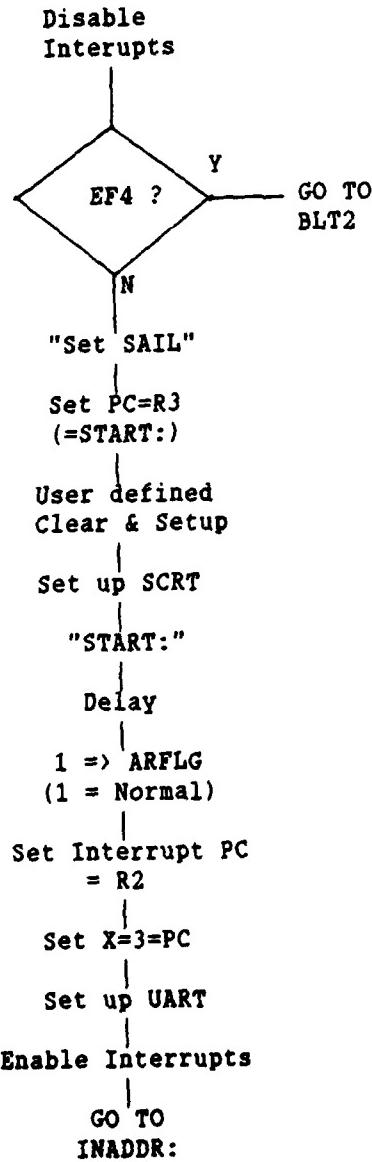
WAIT30 :25 Min.
SEND 7 ;SEND SIG. 7 END OF VELOCITY RUN
RETURN

```
;*****  
;  
; SEQUENCER MACRO SUBROUTINES  
;  
SUBTTL ISDSUB 15 JUL 86  
;  
; This file must be included at the end of a Sequencer Macro Program  
; Use "INCLUDE ISDSUB.MAC"  
;  
;*****  
;  
; CSEG ; Change to Code Segment  
;  
; Note! W10 - W60 allow for the call and return times.  
; ie. W10 is set for 8 sec.  
;  
W10: SETCTC 0008, $+5 ;Wait for 10 Sec.  
JUMP $-1  
RETURN  
;  
;  
W20: SETCTC 0012, $+5 ;Wait for 20 Sec.  
JUMP $-1  
RETURN  
;  
;  
W29: SETCTC 0013, $+5 ;Wait for 29 Sec.  
JUMP $-1  
RETURN  
;  
;  
W30: SETCTC 001C, $+5 ;Wait for 30 Sec.  
JUMP $-1  
RETURN  
;  
;  
W59: SETCTC 0039, $+5 ;Wait for 59 Sec.  
JUMP $-1  
RETURN  
;  
;  
W60: SETCTC 003A, $+5 ;Wait for 60 Sec.  
JUMP $-1  
RETURN  
;  
;  
;  
W1M: SETCTC 003A, $+5 ;Wait for 1 MIN.  
JUMP $-1  
RETURN  
;  
;  
W2M: SETCTC 0076, $+5 ;Wait for 2 MIN.  
JUMP $-1  
RETURN
```

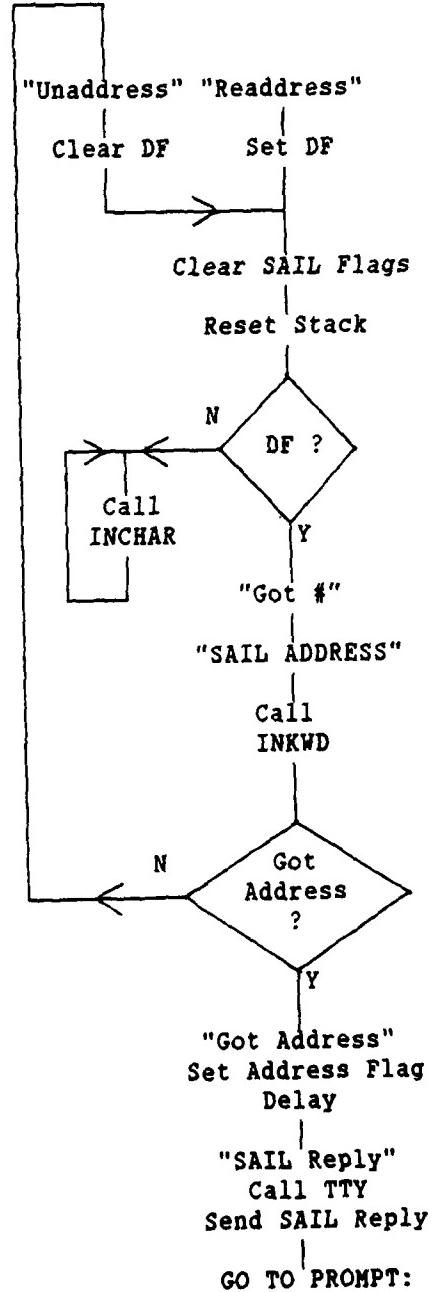
```
;  
;  
W5M: SETCTC 012A, $+5      ;Wait for 5 MIN.  
    JUMP $-1  
    RETURN  
;  
;  
W7M: SETCTC 01A2, $+5      ;Wait for 7 MIN.  
    JUMP $-1  
    RETURN  
;  
;  
;  
;***** END OF SUBROUTINE INCLUDE FILE - ISDSUB *****  
;  
;
```

Appendix B
Sea Duct Monitor Program
Block Diagrams

HARDSTART



UNADDRESS and READDRESS



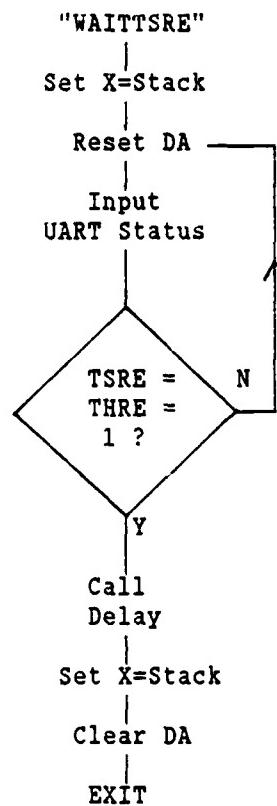
(Appendix B contd.)

```

PROMPT
  |
  "PROMPT"
  |
  Call
  WAITTSRE
  |
  Call
  TTY
  |
  Output CR, LF
  :, ETX
  |
  Call
  WAITTSRE
  |
  GO TO
  "First Branch"

```

WAITTSRE
(Wait for Trans. Ser.
Shift Reg. Ready)

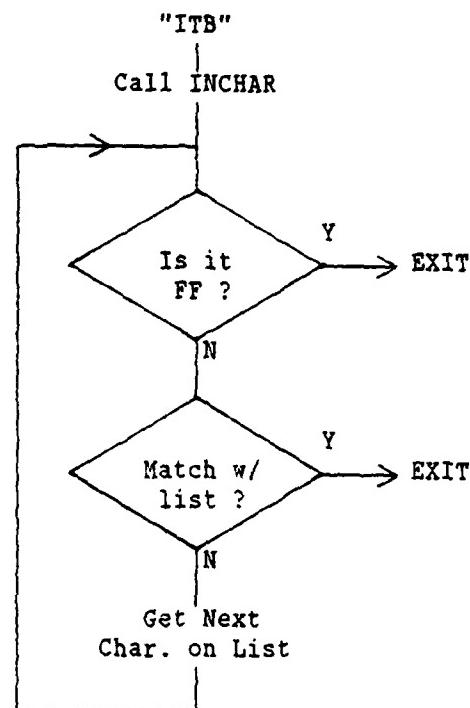


(Appendix B contd.)

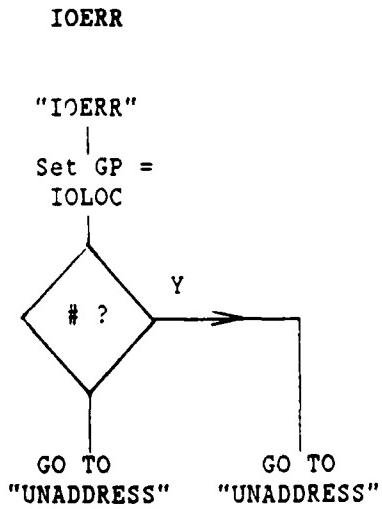
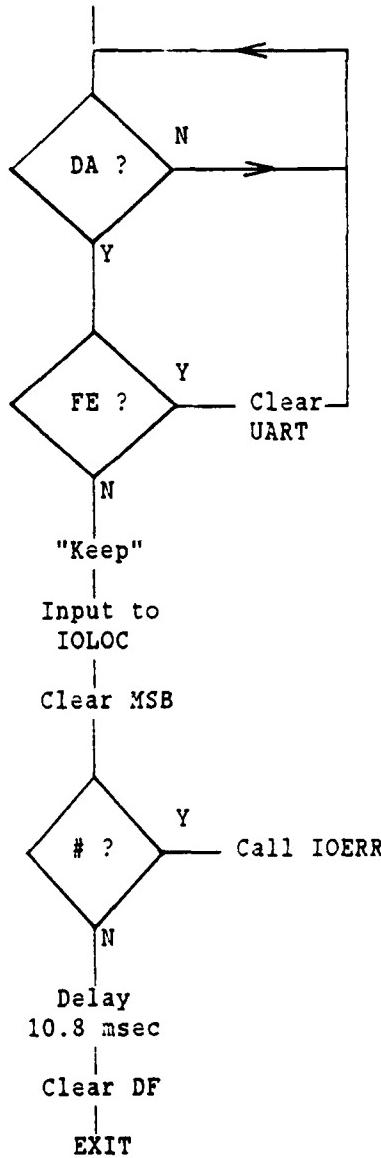
First Branch

```
"First Branch"
    |
    Call ITB
    |
    ? Group
    |
    ! Group
    |
    $ Group
    |
    H Group
    |
    M Group
    |
    (Add others here)
    |
    End of List
    |
    GO TO PROMPT:
```

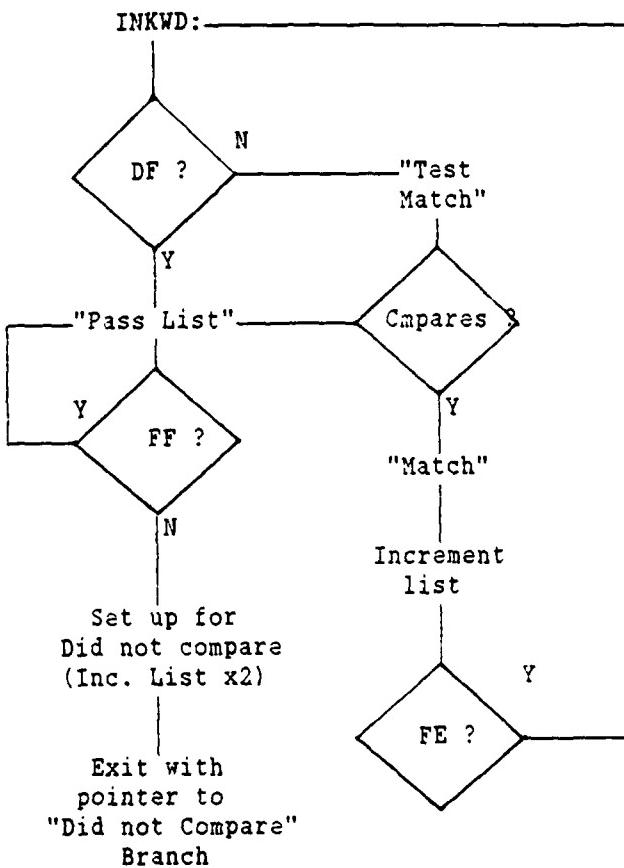
ITB
(Input Test and Branch)



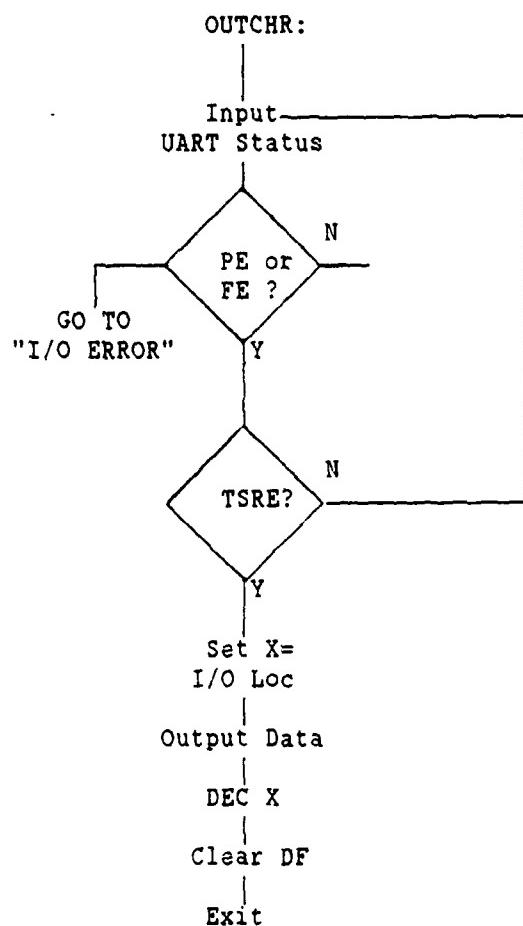
"INCHAR"
Input UART Status



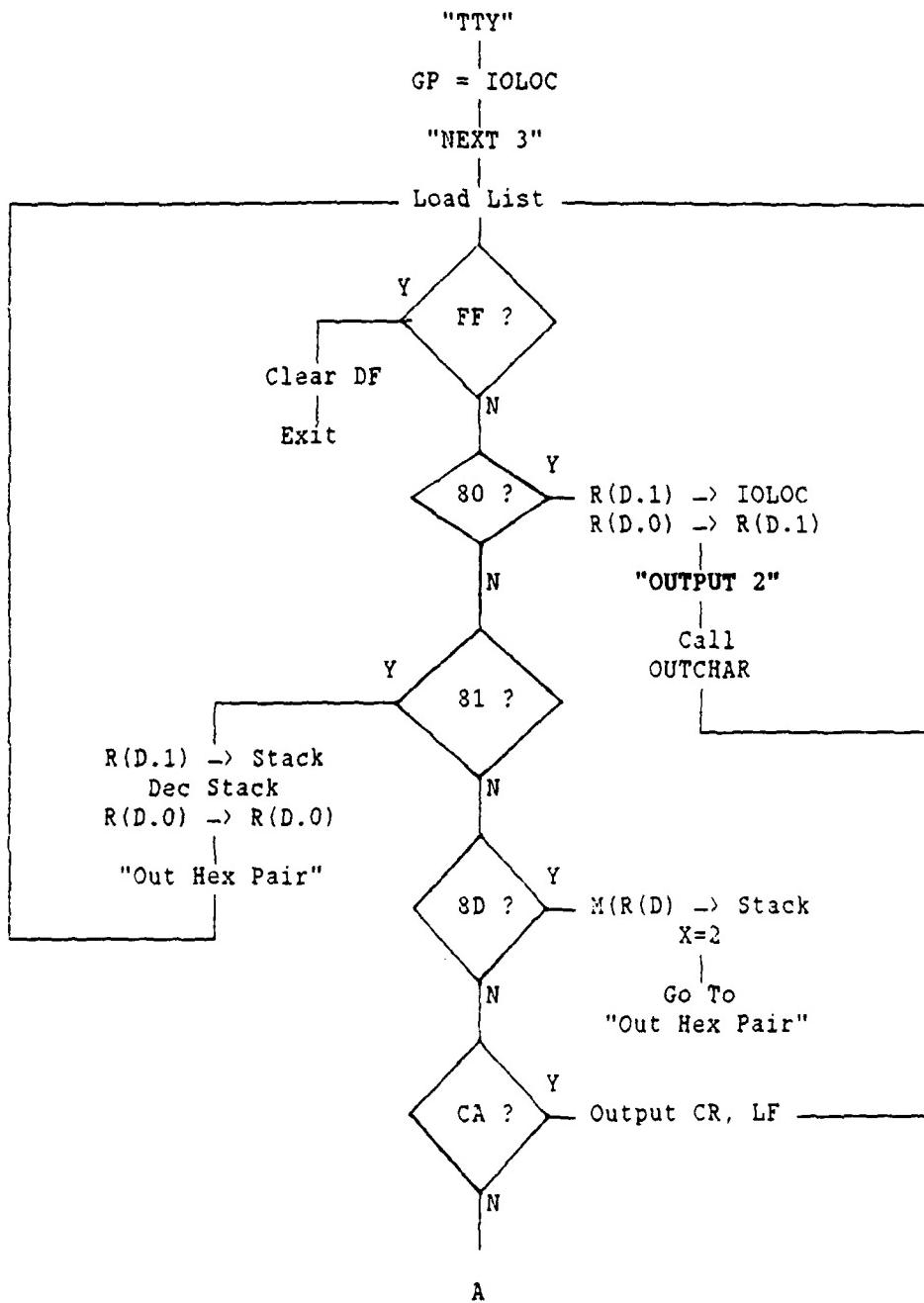
IN KEY WORD



OUT CHARACTER



TTY

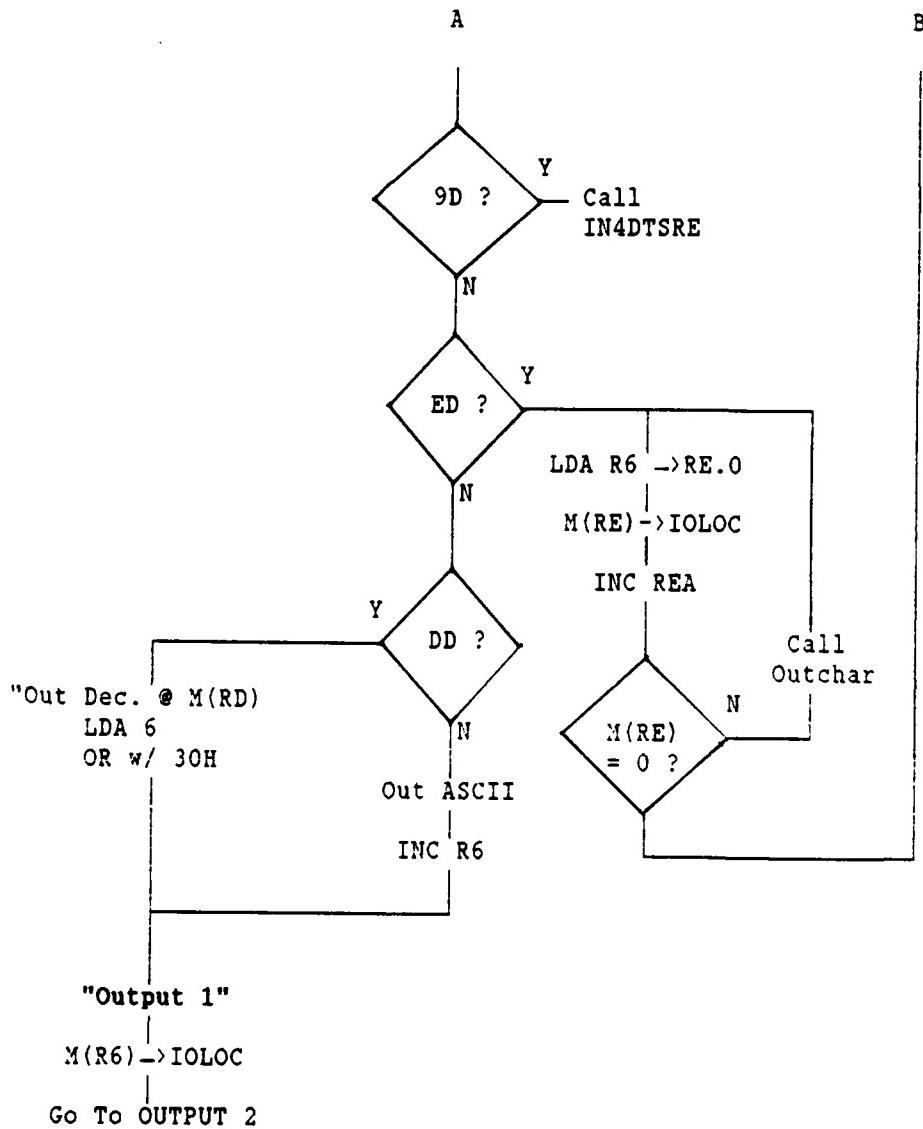


A

B

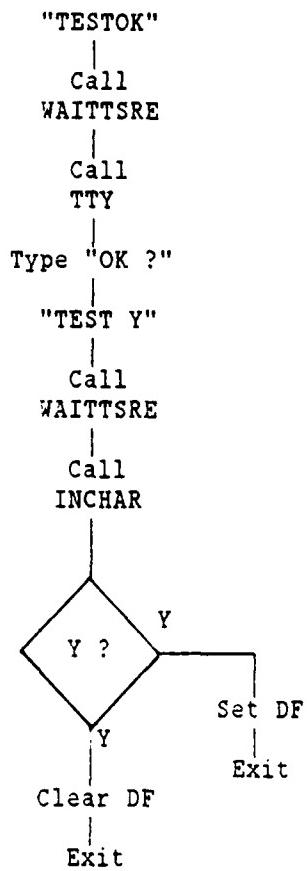
Continued next page

TTY contd.



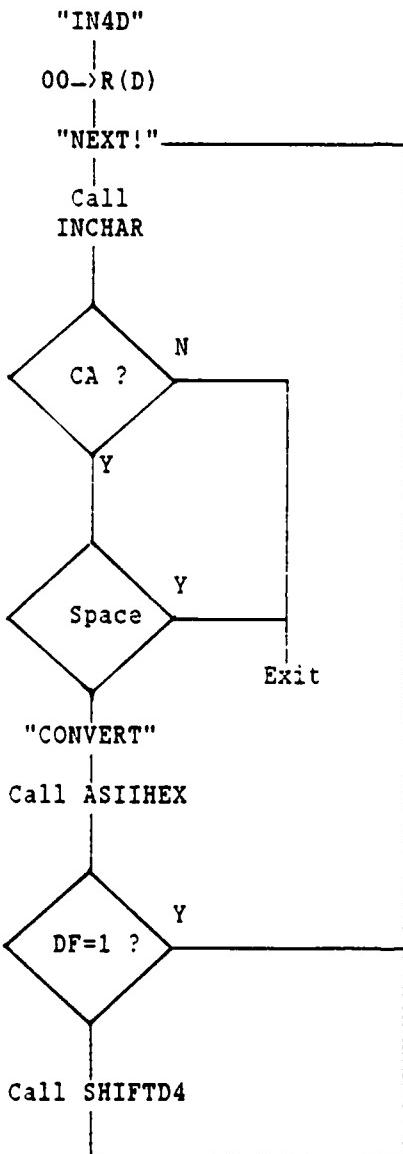
(Appendix B contd.)

TEST OK



(Appendix B contd.)

**IN4D - Input 4
Digits to R(D)**



IN4D

```

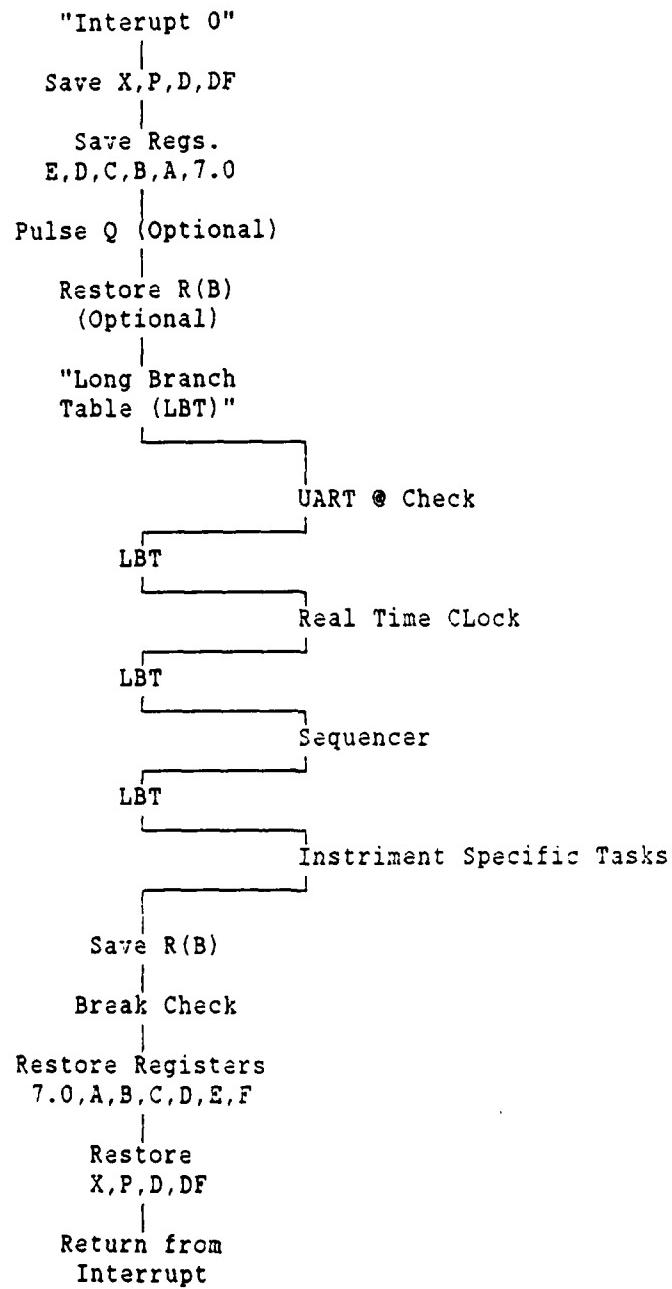
    "SHIFTD4"
    RSHL x4
    OR w/
    IOBYTE
    PLO R(D)
    Exit
  
```

TEST OK

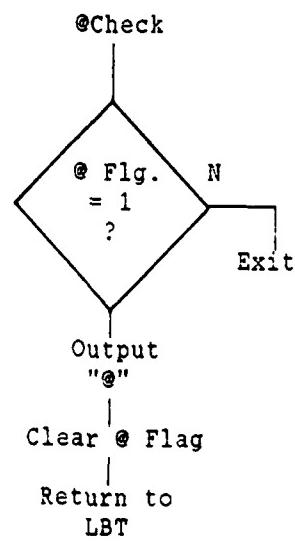
```

    "TESTOK"
    Call WAITTSRE
    Call TTY
    Type "OK ?"
    "TEST Y"
    Call WAITTSRE
    Call INCHAR
    Y ? ——————> Y
    | Set DF
    | Exit
    Clear DF
    Exit
  
```

Interrupt Service Routine



"UART @ Check"



Appendix C

Sea Duct Main Program Program Generation and Listing

SEA DUCT PROGRAM GENERATION

Software used in the Sea Duct System was developed on a CompuPro 816A Computer. The CompuPro 816A uses a modified version of CP/M and CP/M-86 to run 8 and 16 bit programs. All software purchased for the system was designed for eight bit CP/M systems.

The current version of the Sea Duct Main Program, SDSYS5n, is made from two files: SD05Rn and SDE5Rn. These are assembled using the Syscon M18 assembler (for RCA 1802 series) and are linked using L18.

SD05Rn is linked using the command /P:800/D:5000, and SDE5Rn is linked using /P:2000/D:5000; the combined version is called SDSYS5n.HEX. This can be converted to RCA format (file type ".RCA") using the command MBASIC_HXRCA. Appendix D contains a listing of the Hex to RCA format conversion program. The resulting .RCA file can be loaded into Sea Duct system RAM using a version of MCALL named SAIL via the BTU Monitor which resides in PROM at 0000 in the SEA DUCT System. RAM versions are usually used for testing only. At the present time the program is burned into EPROMs which are then installed in the system. Four proms (2716) are needed. They are inserted into prom locations 0800, 1000, 1800, and 2000. For the prom version, a ".COM" version of the program is made using the L18 linker. CP/M Submit files L18COM and L18HEX exist for linking the main program. See the Syscon manual as well as information at the top of each source file for further information. These files exist on disks labeled "Sea Duct Main Prog. - Working Copy" and "1802 Development System". This text and other text files are on the "Sea Duct Text Files". The "1802 Development System" disk is the disk used for assembly, etc. Backup copies of these disks exist.

The proms for the system are programmed using "BURN" and the system object file SDSYSn.COM. "Burn" is a renamed version of PROMPROG, the Optimal Technology prom programming package.

The Sea Duct Sequencer Macro Programs are the ones used to control the Sea Duct does during an actual deployment. These macro programs are on a disk labeled "Sea Duct Sequencer Progs." These are also assembled using Syscon's M18 and are linked using L18. These programs are also made into ".RCA" files using the MBASIC program HXRCA. The sequencer programs are loaded into battery backed ram memory at location 3000 hex. using the a version of MCALL renamed SAIL.COM. SAIL.COM resides on the "1802 Development System" disk. The command "SAIL -Z:SAIL." is used. This connects the Sea Duct computer to the CompuPro computer via the lab SAIL system.

```
1          ;PAGE 60
2          SUBTTL SEA DUCT: SD05R9.MAC 16 SEP 86
3          ;
4 0035      VERS EQU "5"           ;VERSION 5.9
5 0039      REV  EQU "9"
6          ;
7          ;
8          ; PREVIOUS VERS.: SD05R8.MAC 06 SEP 86
9          ; PREVIOUS VERS.: SD05R7.MAC 26 AUG 85
10         ; PREVIOUS VERS.: SD05R6.MAC 08 AUG 86
11         ; PREVIOUS VERS.: SD05R5.MAC 21 JUN 85
12         ;
13         ; Other older versions exist - no longer used.
14         ;
15         ;
16         ;SAIL SEA DUCT PROGRAM
17         ;
18         ;FOR RCA 1806 WITH:
19         ;
20         ;    1877 VECTORED INTERRUPT
21         ;    MEMORY PROTECT.
22         ;    REAL TIME CLOCK.
23         ;    BASIC SEQUENCER
24         ;    PASS THRU MODE W/ LOOP2 PWR CONTROL
25         ;    FAST SEQUENCER W/ LOOP2
26         ;    SEQUENCER TIMEOUT COUNTER
27         ;    EXTENDED SEQUENCER POINTER (EO)
28         ;    A/D, MUX CONTROL
29         ;
30         ;
31 C INCLUDE I1806A.MAC
32 C ; I1806A.MAC - Macro Definitions for RCA 1805A/6A Opcodes
33 C ;
34 C ;
35 C ; 20 FEB 1986
36 C ; W. E. TERRY
37 C ;
38 C ; (LISTING SUPRESSED)
39 C ;
40 C ; With some Level II codes
41 C ;
42 C .LIST
43 C ; Macro Definitions for RCA 1805A/1806A Opcodes
44 C ;
45 C INCLUDE ISDRQU.MAC
46 C ; SEA DUCT EQUATE TABLE - ISDEQU.MAC
```

MACRO-18 3.36 PAGE 1-1
SEA DUCT: SD0589.MAC 16 SEP 86

47 C :
48 C : 26 AUG 86 - SD0587
49 C :
50 C : J. E. TERRY
51 C :
52 C : INCLUDING:
53 C : REGISTER ALLOCATION
54 C : GLOBAL PAGE REFERENCES
55 C : I/O EQUATES
56 C : DEFAULT VALUES
57 C :
58 C : (LISTING SUPPRESSED)
59 C : .LIST
60 C :
61 : Sea Duct Equate Table
62 :
63 :*****
64 :
65 :*** NOTE : EXTENDED SEQUENCER FUNCTIONS ARE NOT ON THIS FILE
66 : SEE FILE TYPES SDEVr.MAC
67 : PUBLIC REFERENCES ARE MADE TO THE EXTENDED FILES
68 :
69 : Assemble using: M18 SD0vRr.=SD0vRr/R/C then use
70 :
71 : CREF80 SD0vRr=SD0vRr to get a .PRM file.
72 :
73 : Link using:
74 : L18 /P:800/D:5000.SD0vRr./P:2000/D:5000.SDEVr.SDSYSvr/M/Z/E
75 : where v = vers. . r = rev.
76 : to link both this file and the extended sequencer file.
77 :
78 :*****
79 :
80 :***** PROGRAM BEGINS HERE *****
81 :
82 :
83 0000' 71 HDSTART: DIS
84 0001' 00 DB 00 ;DISABLE INTERRUPTS
85 :
86 0002' 30 19' BR SETSL ;CAN BE BM4 TO SETSL
87 0004' FFFF DW 0PPPFF ;3 BYTE SPACE FOR LBR TO BLT
88 0006' FF DB 0FFH
89 :
90 0007' 53 45 41 20 DB "SEA DUCT VERS."
91 0008' 44 55 43 54
92 0009' 20 56 45 52

MACRO-18 3.36 PAGE 1-2
 SEA DUCT: SD05R9.MAC 15 SEP 86

```

93 0013' 53 2E
94 0015' 35          DB VERS
95 0016' 2E          DB '.'
96 0017' 39          DB REV
97 0018' 20          DB ''
98 ;
99 0019' 90          SETSL: GHI R0
100 001A' B3          PHI PC      ;SET PC TO STARTING ADDRESS
101 001B' F8 25'      LDI LOW(START1)
102 001D' A3          PLO PC
103 ;
104 001E' F8 53          SETSTK: LDI STKPG
105 0020' B2          PHI STACK   ;PUT STACK LOCATION IN R2
106 0021' F8 DF      LDI LOW STKEND
107 0023' A2          PLO STACK
108 0024' D3          SEP PC      ;PROGRAM BEGINS TO RUN w/ PC = R3
109 ;
110 ;
111 0025' E2          START1: SEX STACK
112                               SCAL R6. MEMSUB ;CALL MEMORY ENABLE SUBROUTINE
113 0025' 68 95      +
114 0028' 07B2'      +
115 002A' 01          DB 01      ; ENABLE
116 002B' 00          DB 00      ; START PAGE = 00
117 002C' FF          DB 0FFH    ; # OF PAGES = FF
118 ;
119                               SCAL R6. SETUP ;CALL FOR USER DEFINED CLEAR &
120 002D' 58 86      +
121 002F' 005A'      +
122 ;
123 ;
124 0031' F8 20          DLY20: LDI 20H
125 0033' BB          PHI RE      ;20 = ARBITRARY DELAY WHICH
126 0034' 2E          WAIT: DEC RE   ; INSURES GART WILL RESET
127 0035' 92          GHI RE
128 0036' 3A 34'      BNE WAIT
129 0038' C4          NOP
130 0039' F8 1D          LDI ARFLG   ;SET RTC A/R FLAG
131 003B' A7          PLO GPAGE
132 003C' F8 01          LDI 01
133 003E' 57          STR GPAGE   ;1 -> A/R FLAG => NORMAL
134 ;
135 ;
136 003F' F8 F8          RESTART: LDI HIGH(INTVEC)
137 0041' B1          PHI INTPC   ;SET R1 = INTERRUPT VECTOR PAGE
138 0042' F8 80          LDI LOW(INTVEC)
  
```

MACRO-18 3.36 PAGE 1-3
SEA DUCT: SD05R9.MAC 16 SEP 85

139 0044' A1 PLO INTPC
140 0045' F8 50 LDI GLOPG ;SET GPAGE.1
141 0047' B7 PHI GPAGE
142 ;
143 0048' F8 0A SETURT: LDI GRPSAV :SELECT UART I/O GROUP
144 004A' A7 PLO GPAGE : AND STORE ON GLOBAL PAGE
145 004B' F8 06 LDI UARTS
146 004D' 57 STR GPAGE
147 004E' B7 SEX GPAGE
148 004F' 61 OUT GROUP
149 0050' 83 SEX PC
150 0051' 63 OUT CNTRL1 :SET UART1 AS SHOWN IN THE I/O GROUP
151 0052' 12 DB FORMT1 : ALLOCATION SETUP
152 ;
153 0053' 65 OUT CNTRL2 :THIS BLOCK:
154 0054' 12 DB FORMT1 ;
155 ;
156 ;
157 ; SCAL R6, INTBR2 :BREAK LOOP 2 AND SETUP UART 2
158 ; :SHOULD BE USED ONLY AT START AND NOT RESTART
159 0055' 83 SEX PC
160 0056' 70 RET
161 0057' 33 DB 33H :ENABLE INTERRUPTS
162 0058' 30 84' BR UNADDR :GO TO UNADDRESS
163 ; :INITIALIZATION IS DONE AT THIS POINT
164 ; : THE PROGRAM IS UP AND RUNNING
165 ;
166 ;*****
167 ;
168 ;***** CLEAR AND INITIALIZE ROUTINE *****
169 ;
170 ;
171 005A' F8 50 SETUP: LDI GLOPG :GLOBAL PAGE SETUP
172 005C' B7 PHI GPAGE :SETS R7.1 TO GLOPG
173 ;
174 005D' F8 FF LDI OFFH :CLEAR 5000 TO 5BEF WITH 00'S
175 005E' AA PLO RA :CONFIGURE THIS SECTION TO
176 0060' F8 5B LDI BUPPG :SUIT THE NEEDS OF YOUR SYSTEM
177 0062' BA PHI RA
178 0063' F8 00 AGAIN: LDI 00H
179 0065' 5A STR RA
180 0066' 2A DEC RA
181 0067' 8A GLO RA
182 0068' 32 5C' B2 CLAPG
183 006A' 30 63' BR AGAIN
184 006C' 9A CLAPG: GHI RA

MACRO-18 3.36 PAGE 1-4
 SEA DUCT: SDO589.MAC 16 SEP 86

```

185 006B' FB 50      XRI GLOPG
186 006F' 32 73'     BZ SEQRST
187 0071' 30 63'     BR AGAIN
188          ;
189          ;
190 0073' F8 60      SEQRST: LDI PPCHI ;INITIALIZE SEQUENCER
191 0075' A7          PLO GPAGE
192 0076' F8 07'     LDI HIGH(IDLLOC)
193 0078' 57          STR GPAGE
194 0079' 17          INC GPAGE
195 007A' F8 00'     LDI LOW(IDLLOC)
196 007C' 57          STR GPAGE
197 007D' 17          INC GPAGE
198 007E' F8 52      LDI HIGH(RSTKTP)
199 0080' 57          STR GPAGE
200 0081' 17          INC GPAGE ;GPAGE AT RSTK POINTER
201 0082' F8 3F      LDI LOW(RSTKTP)
202 0084' 57          STR GPAGE
203 0085' 17          INC GPAGE
204 0086' F8 52      LDI HIGH(ASTKTP)
205 0088' 57          STR GPAGE
206 0089' 17          INC GPAGE
207 008A' F8 7F      LDI LOW(ASTKTP)
208 008C' 57          STR GPAGE
209          ;
210          ;
211 008D' F8 F8      LDI INTPG
212 008F' 9A          PHI RA      ;SET UP PROG. INTERRUPT CONTROLLER
213 0090' F8 00      LDI LOW(INTMSK)
214 0092' AA          PLO RA      ;SET INTERRUPT MASK FOR ONLY INT. 0
215 0093' F8 FE      LDI OFEN
216 0095' 5A          STR RA
217 0096' F8 40      LDI LOW(INTCRL)
218 0098' AA          PLO RA      ;SET PIC CONTROL REG.
219 0099' F8 05      LDI 05
220 009B' 5A          STR RA
221 009C' F8 80      LDI LOW(INTVEC)
222 009E' AA          PLO RA      ;SET PIC VECTOR PAGE REG
223 009F' F8 08'     LDI HIGH(INTPGM)
224 00A1' 5A          STR RA
225          ;
226 00A2' F8 3F      LDI HDGEXP ;SET DEFAULT VALUE FOR THE PLUME HEADING
227 00A4' A7          PLO GPAGE ; FOR THE EXPERIMENT
228 00A5' F8 20      LDI HDGVAL
229 00A7' 57          STR GPAGE
230
  
```

MACRO-18 3.36 PAGE 1-5
SEA DUCT: SD05R9.MAC 16 SEP 86

231 ;
232 ;*** THIS SPACE MAY BE USED FOR FURTHER SETUP ROUTINES ***
233 ;
234 ;
235 00A8' E2 SEX STACK
236 ; SRET R6
237 0019' 68 96 +
238 ;
239 ;
240 ;*****
241 ;
242 ;***** I / O ERROR RECOVER *****
243 ;
244 00AB' E2 IOERR: SEX STACK
245 ;
246 ; SCAL R6, INTBR2 ; REMOVED VERS. 5.8 - 5.9
247 ;
248 00AC' F8 FF LDI IOLOC
249 00AE' A7 PLO GPAGE ;SAIL ENTERS HERE IF
250 00AF' 07 LDW GPAGE ; 1. UART GOT #
251 00B0' F8 23 XRI 023H ; 2. XMIT ECHOED ERROR
252 00B2' 32 37' BZ READDR ;IS INPUT CHARACTER '#' ?
253 ;
254 ;
255 00B4' FC 00 UWADD: ADI 00H ;CLEAR DF
256 00B6' C8 LSXP
257 00B7' FF 00 READDR: SMI 00H ;SET DF
258 00B9' F8 03 LDI SYSFLG
259 00BB' A7 PLO GPAGE ;DF = 1 MEANS IT GOT '#'
260 00BC' B7 SEX GPAGE
261 00BD' F8 00 LDI 00H
262 00BF' 73 STID
263 00C0' 73 STID
264 00C1' 73 STID ;CLEAR SAIL FLAGS AT
265 00C2' 57 STR GPAGE ;GLOBAL PAGE 00 THRU 03
266 ;
267 ;
268 ;*****
269 ; LDI SYSFLG ;REMOVE THE BEGINNING ';' FOR
270 ; PLO GPAGE ; PERMANENT OPEN SYSTEM
271 ; LDI 50H ;MAKE THESE STATEMENTS COMMENTS FOR
272 ; STR GPAGE ; NORMAL SYSTEM OPERATION
273 ;*****
274 ;
275 ;
276 00C3' F8 DF LDI LOW STEND

MACRO-18 3.36 PAGE 1-6
SEA DUCT: SD05R9.MAC 16 SEP 86

277 00C5' A2 PLO STACK ;RESET STACK
278 00C6' 33 CP' BDF GOTNUM
279 00C8' E2 POUND?: SEX STACK
280 SCAL R6. INCHAR
281 00C9' 68 86 +
282 00CB' 0181' +
283 00CD' 30 C8' BR POUND?
284 00CF' 30 D1' GOTNUM: BR ADDR?
285 :
286 :
287 :***** SAIL ADDRESS *****
288 :
289 :
290 00D1' E2 ADDR?: SEX STACK
291 SCAL R6. INHWD ;LOOK FOR NOTE: SAIL ADDRESS
292 00D2' 68 86 +
293 00D4' 0208' +
294 00D6' 53 44 DB 'SD' ; IS INSTRUMENT SPECIFIC
295 00D8' FF DB DONE ; DONE
296 00D9' 00DE' DV ADDR
297 00DB' C0 00B4' LBR UNADDR
298 :
299 :
300 :***** GOT SAIL ADDRESS *****
301 :
302 :
303 00DE' F8 03 ADDR: LDI SYSFLG
304 00E0' 17 PLO GPAGE ;ENTERS FROM SAIL ADDRESS
305 00E1' 07 LDW GPAGE
306 00E2' F9 80 ORI 080H
307 00E4' 57 STR GPAGE
308 00E5' E2 SEX STACK
309 SCAL R6. DELAY2 ;2 BIT DELAY
310 00E6' 68 86 +
311 00E8' 019B' +
312 00EA' 30 EC' BR RPLY
313 :
314 :
315 :***** INSTRUMENT SAIL REPLY *****
316 :
317 :
318 00EB' RPLY: SCAL R6. TTY ;TYPE:
319 00EC' 68 86 +
320 00EE' 0248' +
321 00F0' CA DB OCAB
322 00F1' 53 65 61 20 DB 'Sea Duct' ; REPLY

MACRO-18 3.36 PAGE 1-7
SEA DUCT: SD05R9.MAC 16 SEP 86

323 00P5' 44 75 63 74
324 00P9' 20 20 56 65 DB ' Vers. '
325 00PD' 72 73 28 20
326 0101' 35 DB VERS
327 0102' 28 DB ''
328 0103' 39 DB RV
329 0104' FF DB DONE : DONE
330 0105' 30 07' BR PROMPT
331 :
332 :
333 :***** PROMPT *****
334 :
335 :
336 0107' 22 PROMPT: SEX STACK
337 SCAL R6. TSRE? :WAIT FOR TRANS. SER. REG. EMPTY
338 0108' 58 85 +
339 010A' 02F0' +
340 SCAL R6. TTY :TYPE:
341 010C' 58 86 +
342 010Z' 024E' +
343 0110' CA DB OCAN : CR. LF
344 0111' 3A DB PNTCR : PROMPT CHAR
345 0112' 03 DB ETX : ETX
346 0113' FF DB DONE : DONE
347 SCAL R6. TSRE? :WAIT FOR TRANS. SER. REG. EMPTY
348 0114' 58 86 +
349 0116' 02F0' +
350 0118' 30 1A' BR BRIST :GO TO FIRST BRANCH
351 :
352 :
353 :***** FIRST BRANCH *****
354 :
355 :
356 011A' BRIST: SCAL R6. ITB :TEST FOR: :ADD OR DELETE
357 011A' 58 86 +
358 011C' 022E' +
359 011E' 3F DB '?' :? GROUP : AS NECESSARY
360 011F' 0133' DW QUESGR : FOR YOUR SYSTEM
361 0121' 21 DB '!' :! GROUP
362 0122' 014F' DW BANGGR
363 0124' 24 DB 'S' :S GROUP
364 0125' 0472' DW TESTS
365 0127' 48 DB 'H' :HELP FILE
366 0128' 1000' DW HELP
367 012A' 4D DB 'M' :MEMORY PROTECT
368 012B' 0734' DW MEMSAV

MACRO-18 J.36 PAGE 1-8
SEA DUCT: SD05R9.MAC 16 SEP 86

369 012D' 25 DB 'V' :PASS THRU GROUP
370 012E' 0171' DW PASSGR
371 0130' FF DB DONE :DONE :EXPANSION CAN BE
372 0131' 30 07' BR PROMPT :ADDED HERE
373 ;
374 ;
375 ;***** ? GROUP *****
376 ;
377 ;
378 0133' QUESGR: SCAL R6. ITB :LOOK FOR: :ADD OR DELETE
379 0133' 68 86 + DB 'M' ; AS NECESSARY
380 0135' 0228' + DW QUESTM :? M
381 0137' 4D DB 'C'
382 0138' 0395' DW QUESTM :? C
383 013A' 43 DB 'T'
384 013B' 04A2' DW CRC :? CRC
385 013D' 54 DW QUESTT :? TIME
386 013E' 05C2' DW SEQ? :? SEQUENCER
387 0140' 53 DB 'B'
388 0141' 0684' DW QUBUF :? Buffer
389 0143' 42 DW 'H'
390 0144' 1178' DW HDG? :? Heading
391 0146' 48 DB 'Y'
392 0147' 129D' DW EXP? :? Experiment #
393 0149' 45 DW DONE :DONE :EXPANSION CAN BE
394 014A' 12DC' BR PROMPT :ADDED HERE
395 014C' FF ;
396 014D' 30 07' ;
397 ;
398 ;
399 ;***** ? GROUP *****
400 ;
401 ;
402 014P' BANGGR: SCAL R6. ITB :LOOK FOR: :ADD OR DELETE
403 014P' 68 86 + DB 'L' ; AS NECESSARY
404 0151' 0228' + DW LOCK :? LOCK
405 0153' 4C DB 'U'
406 0154' 0331' DW UNLOCK :? UNLOCK
407 0156' 55 DB 'O'
408 0157' 0315' DW OPEN? :? OPEN SYS
409 0159' 4F DB 'R'
410 015A' 0348' DW WRITEN :? MEMORY
411 015C' 4D DB 'T'
412 015D' 03F5' DW TINEST :? TIME

MACRO-18 3.35 PAGE 1-9
SEA DUCT: SD05R9.MAC 16 SEP 86

415 0162' 53 DB 'S'
416 0163' 0602' DW SEQSET ;: SEQUENCER
417 0165' 46 DB 'T'
418 0166' 0704' DW PPCSHO ;: FOLLOW PPC
419 0168' 48 DB 'H'
420 0169' 1273' DW HDGSET ;: SET HEADING
421 016B' 45 DB 'E'
422 016C' 12B9' DW EXPSET ;: SET EXPERIMENT #
423 016E' FF DB DONE ;:DONE ; EXPANSION CAN BE
424 016F' 30 07' BR PROMPT ;: ADDED HERE
425 ;
426 ;
427 ;***** PASS THRU GROUP *****
428 ;
429 ;
430 0171' PASSGR: SCAL R6. ITB
431 0171' 58 86 +
432 0173' 022E' +
433 0175' 50 DB 'P' ;START PASS THRU MODE
434 0176' 1540' DW PTHRU ;
435 0178' 42 DB 'B' ;SEND BREAK *** BOTH SEND A
436 0179' 153E' DW PASSBR ;
437 017B' 58 DB 'X' ;ESCAPE (DROP ONE LEVEL) * BREAK UNLESS
438 017C' 153E' DW PASSBR ;
439 017E' FF DB DONE ;:DONE EXPANSION CAN BE *** BEEN ENTERED
440 017F' 30 07' BR PROMPT ;: ADDED HERE
441 ;
442 ;
443 ;***** SAIL IN CHARACTER *****
444 ;
445 0181' 6B INCHAR: INP STAT1
446 0182' F6 SHR ;CHECK FOR DA (DATA AVAILABLE)
447 0183' 3B 81' BNP INCHAR ;IF NOT TRY AGAIN
448 0185' FA 06 ANI 06H ;MASK FOR:
449 0187' 32 8C' BZ KEEP2 ; FRAMES AND PARITY ERROR
450 0189' 6A INP DATA1 ;CLEAR BAD DATA
451 018A' 30 81' BR INCHAR
452 018C' F8 FE KEEP2: LDI IOLOC ;PUT GOOD DATA AT GP = I/O LOCATION
453 018E' A7 PLO GPAGE
454 018F' E7 SEX GPAGE
455 0190' 6A INP DATA1
456 0191' FA 7F ANI 07FH ;CLEAR MSB
457 0193' 57 STR GPAGE ;STORE AT GP I/O LOCATION
458 0194' FD 23 IXI '4' ;IS IT '4' ?
459 0196' C2 00AB' LBZ IOERR
460 0199' 30 9B' BR DELAY2 ;2 BIT DELAY

MACRO-18 3.36 PAGE 1-10
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

461          ;
462          ;
463          ;***** 2 BIT DELAY *****
464          ;
465          ;INSTRUMENT SPECIFIC:
466 019B' F8 80  DELAY2: LDI 80H   ; 80H = 10.8 mSec POR
467 019D' FF 01  WAIT3: SMI 01H   ; 1.2288 MHZ SYSTEM CPU CLOCK
468 019F' C4      NOP
469 01A0' C4      NOP
470 01A1' C4      NOP
471 01A2' 3A 9D'  BWZ WAIT3
472 01A4' FC 00  ADI 00H   ;CLEAR DF
473 01A6' E2      SEI STACK
474          SRET R6
475 01A7' 68 96  +
476          ;
477          ;
478          ;***** INPUT 4 DIGITS TO R(D) - (IN4D) *****
479          ;
480          ;
481 01A9' F8 00  IN4D: LDI 00
482 01AB' BD      PHI RD   ;SET R(D) = 0000
483 01AC' AD      PLO RD
484 01AD'          NEXT1: SCAL R6. INCHAR
485 01AD' 68 86  +
486 01AF' 0181'  +
487 01B1' 07      LDW GPAGE
488 01B2' FB 0D  XRI 0DH   ;INCHAR IOR CR IS IT 'CR' ?
489 01B4' 32 BA' 0Z IN4DIT  ;GP -> I/O LOC.
490 01B6' FB 2D  XRI 2DH   ;"SPACE" IOR CR IS IT ' ' ?
491 01B8' 3A BC' 0BZ CHVRT
492 01BA'          IN4DIT: SRET R6
493 01BA' 68 95  +
494          ;
495          ;
496 01BC'          CHVRT: SCAL R6. ASCHEX
497 01BC' 68 86  +
498 01BK' 01C8'  +
499 01C0' 33 AD'  BDP NEXT1
500          SCAL R6. SHIFTD4
501 01C2' 68 86  +
502 01C4' 01EF'  +
503 01C6' 30 AD'  BR NEXT1
504          ;
505          ;ASCII TO HEX CONVERSION
506 01C8' 07      ASCHEX: LDW GPAGE
  
```

MACRO-18 3.36 PAGE 1-11
SEA DUCT: SD05R9.MAC 16 SEP 86

507	01C9'	PC B0	ADI 0D0E	:CALLED BY GMOV7 AND : MEMORY
508	01CB'	CB 01EB'	LBNF NOTHEX	
509	01CE'	07	LDW GPAGE	
510	01CP'	FD 39	SDI 039H	
511	01D1'	C3 01E3'	LBDP NUMBER	
512	01D4'	07	LDW GPAGE	
513	01D5'	PC BF	ADI 0BPH	
514	01D7'	CB 01EB'	LBNF NOTHEX	
515	01DA'	07	LDW GPAGE	
516	01DB'	FD 46	SDI 046H	
517	01DD'	3B EB'	BWF NOTHEX	
518	01DF'	07	LDW GPAGE	
519	01E0'	FC C9	ADI 0C9H	
520	01E2'	38	SXP	
521	01E3'	07	NUMBER: LDW GPAGE	
522	01E4'	FA 0F	ANI 00FH	
523	01E6'	57	STR GPAGE	
524	01E7'	FC 00	ADI 00H	:CLEAR DF
525			SRET R6	
526	01E9'	58 95	+ :	
527	01EB'	FF 00	NOTHEX: SMI 00H	:SET DF
528			SRET R6	
529	01ED'	58 96	+ :	
530			:	
531			:	
532	01EF'	8C	SHFTD4: GLO RC	
533	01FO'	52	STR STACK	
534	01F1'	F8 04	LDI 0AH	
535	01F3'	AC	PLO RC	
536	01F4'	8D	SHIFT: GLO RD	
537	01F5'	FE	SHL	
538	01F6'	AD	PLO RD	
539	01F7'	9D	GHI RD	
540	01F8'	7E	SHLC	
541	01F9'	BD	PBI RD	
542	01FA'	2C	DEC RC	
543	01FB'	8C	GLO RC	
544	01FC'	CA 01F4'	LBNZ SHIFT	
545	01FF'	02	LDW STACK	
546	0200'	AC	PLO RC	
547	0201'	E7	SEX GPAGE	
548	0202'	8D	GLO RD	
549	0203'	F1	OR	
550	0204'	AD	PLO RD	
551	0205'	E2	SEX STACK	
552			SRET R6	

MACRO-18 3.36 PAGE 1-12
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

553 0206' 68 96      +
554                               ;
555                               ;
556                               ;***** IN KEY WORD *****
557                               ;
558 0208' E2              INWD: SEX STACK
559                               SCAL R6, INCHAR
560 0209' 68 96      +
561 0208' 0181'      +
562 020D' 3B 19'      BNW MATCH?
563 020F' 46          PLIST: LDA LIST
564 0210' FB FF      IRI OPPH ;IS IT FF ? FF = LIST END
565 0212' 3A 0F'      BNZ PLIST
566 0214' 16          INC LIST
567 0215' 16          INC LIST
568 0216' E2          SEX STACK
569                               SRET R6 ;GOES TO LBR AT END OF LIST
570 0217' 68 96      +
571                               ;
572 0219' 07          MATCH?: LDW GPAGE ;GPAGE = I/O LOC.
573 021A' 86          SEX RTNPTR
574 021B' F3          IOR ;DOES I/O LOC = LIST ?
575 021C' 3A 0F'      BNZ PLIST
576 021E' 16          MATCH: INC LIST
577 021F' 06          LDW LIST
578 0220' FB FF      IRI OPPH
579 0222' 3A 08'      BNZ INWD
580 0224' 16          INC LIST
581 0225' 46          LDA RTNPTR
582 0226' 52          STR STACK
583 0227' 46          LDA RTNPTR
584 0228' 16          PLO RTNPTR
585 0229' 02          LDW STACK
586 022A' 86          PHI RTNPTR
587 022B' E2          SEX STACK
588                               SRET R6 ;GOES RETURN INDICATED AT LIST END
589 022C' 68 95      +
590                               ;
591                               ;
592                               ;***** INPUT TEST AND BRANCH *****
593                               ;
594                               ;
595 0228' E2          ITB: SEX STACK
596                               SCAL R6, INCHAR
597 022F' 68 86      +
598 0231' 0181'      +
  
```

MACRO-18 3.36 PAGE 1-13
SEA DUCT: SD05R9.MAC 16 SEP 86

599 0233' 87 SEX GPACE
600 0234' 46 NEXT2: LDA LIST
601 0235' FB FF XRI OFFH ;IS LIST FF?
602 0237' 3A 3C' BMZ TEST
603 0239' E2 SEX STACK
604 023A' 46 SRET R6
605 023A' 68 96 +
606 023C' FB FF TEST: XRI OFFH
607 023E' F3 XOR
608 023F' 32 45' BZ MATCH2 ;DOES CHAR = LIST?
609 0241' 16 INC LIST
610 0242' 16 INC LIST
611 0243' 30 34' BR NEXT2
612 0245' 46 MATCH2: LDA R6
613 0246' 52 STR STACK
614 0247' 46 LDA R6
615 0248' 16 PLO R6
616 0249' 02 LDW STACK
617 024A' 36 PHI R6
618 024B' E2 SEX STACK
619 024C' 46 SRET R6
620 024C' 68 96 +
621 :
622 :
623 :***** TTY *****
624 :
625 :
626 024B' FB FF TTY: LDI IOLOC
627 0250' A7 PLO GPACE ;TTY CHECKS FOR THE FOLLOWING PSEUDO OPS IN LIST:
628 0251' 46 NEXT3: LDA R6 ;*****
629 0252' FB FF XRI OFFH ;IS IT FF? : ASCII CHAR -> TYPES IT
630 0254' 3A 5A' BMZ TEST80 ; 80 = TYPES ASCII @ RD.1
631 0256' FC 00 ADI 00H ;CLEAR DF ; 81 = HEX PAIR @ RD.1
632 0258' 46 SRET R6 ; 2nd CALL SENDS HX PR @ RD.0
633 0258' 68 96 +
634 : ; 8D = HEX PAIR @ M(RD), INC RD
635 025A' FB 7F TEST80: XRI (80H XOR OFFH) ; CA = TYPES CR, LF
636 025C' 3A 68' BMZ TEST81 ;IS IT 80? ; 9D = CALLS IN4D
637 025D' 9D ASCRD1: GHI RD ; DD = DECIMAL @ M(RD)(00-99), INC RD
638 025F' 57 STR GPACE ; A1 = SEND HI HX NIBBLE @ M(RD)
639 0260' 8D GLO RD ; A2 = SEND LO HX NIBBLE @ M(RD), INC RD
640 0261' BD PHI RD ; FF = DONE (END OF LIST)
641 0262' OUTPT2: SCAL R6, OUTCHR ;*****
642 0262' 68 86 +
643 0264' 0300' +
644 0266' 30 51' BR NEXT3

MACRO-18 3.36 PAGE 1-14
SEA DUCT: SD05R9.MAC 16 SEP 86

545 ;
546 0268' FB 01 TEST81: XRI (81H XOR 80H) ;81 XOR 80
547 026A' 3A 88' BMZ TEST8D ;IS IT 81?
548 026C' 9D ;HEXRD1: GHI RD
549 026D' E2 SEXI STACK
550 026E' 73 STKD
551 026F' 8D GLO RD
552 0270' 88 PHI RD
553 0271' 12 OUTHEX: INC STACK
554 0272' 02 LDW STACK
555 0273' 22 DEC STACK
556 0274' F6 SHR
557 0275' F5 SHR
558 0276' F6 SHR
559 0277' F6 SHR
560 0278' 57 STR GPAGE
561 ; SCAL R6. HICONV
562 0279' 68 86 +
563 027B' 02D4' +
564 027D' 12 INC STACK
565 027E' 02 LDW STACK
566 027F' FA 0F AMI OFH
567 0281' 57 STR GPAGE
568 ; SCAL R6. HICONV
569 0282' 68 86 +
570 0284' 02D4' +
571 0286' 30 51' BR SEIT3
572 ;
573 ;
574 0288' FB 0C TEST8D: XRI (8DH XOR 81H)
575 028A' 3A 91' BMZ TESTCA ;IS IT 8D ?
576 028C' 4D LDA RD
577 028D' E2 SEXI STACK
578 028E' 73 STKD
579 028F' 30 71' BR OUTHEX
580 ;
581 0291' FB 47 TESTCA: XRI (OCAB XOR 8DH) ;IS IT CA ?
582 0293' 3A 98' BMZ TEST9D ;OUTPUT CR. LF
583 0295' + OUTCA: SCAL R6. TTY
584 0295' 68 86 +
585 0297' 024H' +
586 0299' 0D0A DW ODOAH
587 029B' FE DB DONE ;DONE
588 029C' 30 51' BR SEIT3
589 ;
590 029E' FB 57 TEST9D: XRI (9DH XOR OCAB)

MACRO-18 3.36 PAGE 1-15
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

691 02A0' 3A A8'      ;BNZ TESTDD      ;IS IT 9D ?
692                           SCAL R6, IN4DT?  ;ONLY CALL OF IN4DT?
693 02A2' 68 86          +
694 02A4' 02E9'          +
695 02A6' 30 51'          BR NEXT3
696                           ;
697 02A8' FB 40          TESTDD: XRI (0DDH XOR 09DH)  ;IS TI DD ?
698 02AA' 3A B1'          BNZ TESTA1      ;EXTEND TTY W/ BRANCH FROM HERE
699 02AC' 4D              LDA RD
700 02AD' F9 30          ORI 030H
701 02AF' 30 B1'          BR OUTPT1
702                           ;
703 02B1' FB 7C          TESTA1: XRI (0A1H XOR 0DDH)  ;IS IT A1 ?
704 02B3' 3A C1'          BNZ TESTA2
705 02B5' 0D              LDW RD
706 02B6' F5              SHR
707 02B7' F6              SHR
708 02B8' F6              SHR
709 02B9' F6              SHR
710 02BA' 57              STR GPAGE
711                           SCAL R6, HXCONV
712 02BB' 68 86          +
713 02BD' 02D4'          +
714 02BF' 30 51'          BR NEXT3
715                           ;
716 02C1' FB 03          TESTA2: XRI (0A2H XOR 0A1H)  ;IS TI A2 ?
717 02C3' 3A CF'          BNZ OUTASC
718 02C5' 4D              LDA RD      ;B(D)=R(D)+1
719 02C6' F1 07          AND OP#F
720 02C8' 57              STR GPAGE
721                           SCAL R6, HXCONV
722 02C9' 68 86          +
723 02CB' 02D4'          +
724 02CD' 30 51'          BR NEXT3
725                           ;
726 02CF' 26              OUTASC: DEC R6
727 02D0' 46              LDA R6
728 02D1' 57              OUTPT1: STR GPAGE
729 02D2' 30 52'          BR OUTPT2
730                           ;
731 02D4' 07              HXCONV: LDW GPAGE      ;ONLY USED BY TTY
732 02D5' FC F6          AND OP#F
733 02D7' C3 02E4'        LDOP GT#9
734 02DA' 07              LDW GPAGE
735 02DB' F9 30          ORI 030H
736 02DD' 57              STORE: STR GPAGE
  
```

MACRO-18 3.36 PAGE 1-16
SEA DUCT: SD05R9.MAC 16 SEP 86

737 SCAL R6. OUTCHR
738 02DE' 68 86 +
739 02E0' 0300' +
740 SRET R6
741 02E2' 68 96 +
742 ;
743 02E4' FC 41 GTR9: ADI 041H
744 02E6' C0 02DD' LBR STORE
745 ;
746 ;
747 ;***** IN4D TSRE *****
748 ;
749 ;
750 02E9' IN4DT?: SCAL R6, TSRE?
751 02E9' 68 86 +
752 02EB' 02F0' +
753 02ED' C0 01A9' LBR IN4D
754 ;
755 ;
756 ;***** WAIT FOR TRANS. SER. REG. EMPTY *****
757 ; (LOOP 1)
758 ;
759 ; :CALLED BY PROMPT, TEST OK.
760 02F0' E2 TSRE?: SEX STACK ; AND IN4DTSR, AND PASSTHRU
761 02F1' 6A WAIT4: INP DATA1 ;CLEAR DA (DATA AVAILABLE)
762 02F2' 6B INP STAT1
763 02F3' FA C0 AMI OC0H ;MASK FOR TSRE & THRE
764 02F5' FB C0 XRI OC0H ;TSRE = THRE = 1 ?
765 02F7' 3A F1' BNZ WAIT4
766 SCAL R6. DELAY2 ;2 BIT DELAY
767 02F9' 68 86 +
768 02FB' 019B' +
769 02FD' 6A INP DATA1 ;CLEAR ECHO DA
770 SRET R6
771 02FE' 68 96 +
772 ;
773 ;
774 ;***** SAIL OUT CHARACTER *****
775 ; (LOOP 1)
776 ;
777 0300' 6B OUTCHR: INP STAT1
778 0301' FA 0C AMI OC0H ;CHECK PREVIOUS I/O ERROR
779 0303' CA 00AB' LBNZ IOERR
780 0306' 02 THRE?: LDW STACK
781 0307' FE SHL ;CHECK THRE
782 0308' 3B 00' BNZ OUTCHR ;WAIT FOR UART READY

MACRO-18 1.36 PAGE 1-17
SEA DUCT: SD05R9.MAC 16 SEP 86

783	030A'	E7	SEX GPAGE
784	030B'	F8 FF	LDI IOLOC
785	030D'	A7	PLO GPAGE
786	030E'	52	OUT DATA1 :LOAD UART FROM I/O LOCATION
787	030F'	27	DEC GPAGE
788	0310'	EC 00	ADI 00H :CLEAR DF
789	0312'	E2	SEX STACK
790			SRET R6
791	0313'	58 96	+ ;
792			;
793			;
794			:***** : UNLOCK *****
795			;
796			;
797	0315'		UNLOCK: SCAL R6. INKWD :LOOK POR:
798	0315'	58 86	+ ;
799	0317'	0208'	+ ;
800	0319'	48 4C 4F 43	DB 'BLOCK' ; BLOCK
801	031D'	4B	
802	031E'	FF	DB DONE ; DONE
803	031F'	0324'	DW MOLOCK :BR TO MOLOCK
804	0321'	C0 035D'	LBR SAYNO
805	0324'	F8 40	MOLOCK: LDI 40H
806	0326'	52	STR STACK
807	0327'	E2	SETPLG: SEX STACK
808	0328'	F8 03	LDI SYSPLG
809	032A'	A7	PLO GPAGE
810	032B'	07	LDW GPAGE
811	032C'	F1	OR :STORE WRITE FLAG
812	032D'	57	MODELG: STR GPAGE
813	032E'	C0 0107'	LBR PROMPT
814			;
815			;
816			:***** : LOCK *****
817			;
818			;
819			;
820	0331'		LOCK: SCAL R6. INKWD
821	0331'	58 86	+ ;
822	0333'	0208'	+ ;
823	0335'	4F 43 4B	DB 'OCK'
824	0338'	FF	DB DONE
825	0339'	033D'	DW LOCKUP
826	033B'	30 5D'	BR SAYNO
827	033D'	F8 9F	LOCKUP: LDI 9FH
828	033E'	52	STR STACK

MACRO-18 3.36 PAGE 1-18
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

829 0340' E2           CLRPLG: SRX STACK
830 0341' F8 03         LDI SYSPLG
831 0343' A7           PLO GPAGE
832 0344' 07           LDN GPAGE
833 0345' F2           AND      :CLEAR WRITE AND SYS FLAGS
834 0346' 30 2D'       BR MODFLG
835 ; 
836 ;
837 ;***** OPEN SYS *****
838 ;
839 ;
840 0348'               OPEN?: SCAL R6, INKWD
841 0348' 68 86          +
842 0348' 0208'          +
843 034C' 50 45 48        DB 'PEN'   :LOOK FOR:
844 034B' 20 53 59 53        DB 'SYS'   ;     PEN SYS
845 0353' FF             DB DONE    ;     DONE
846 0354' 0358'          DW OPEN
847 0356' 30 5D'          BR SAYNO
848 0358' F8 20          OPEN: LDI 20H
849 0358' 52             STR STACK
850 035B' 30 27'          BR SETPLG  :SET SYS FLAG
851 ;
852 ;
853 ;***** SAY NO ! *****
854 ;
855 035D' E2           SAYNO: SRX STACK
856 ;                   SCAL R6, DELAY2
857 035B' 68 86          +
858 0360' 019B'          +
859 ;                   SCAL R6, TTY
860 0362' 68 86          +
861 0364' 0248'          +
862 0366' 2048          DW 204EH   :TYPE: SPACE NO !
863 0368' 6P20          DW 6P20H   ;     DONE
864 036A' 21FF          DW 21PPH
865 036C' CO 0107'       LBR PROMPT
866 ;
867 ;
868 ;***** TEST OK ? *****
869 ;
870 036E' E2           TESTOK: SRX STACK
871 ;                   SCAL R6, TSRE?
872 0370' 68 86          +
873 0372' 02P0'          +
874 ;                   SCAL R6, TTY  ;TYPE: OK ? .
  
```

MACRO-18 3.36 PAGE 1-19
SEA DUCT: SD05R9.MAC 15 SEP 86

875 0374' 68 86 +
876 0376' 024E' +
877 0378' 20 4F 5B 20 DB 'OK ?'
878 037C' 3F 20
879 037E' 03 DB ETI ; ETI
880 037F' FF DB DONE ; DONE
881 0380' E2 TESTY: SEX STACK
882 SCAL R6. TSRE?
883 0381' 68 86 +
884 0383' 02PO' +
885 SCAL R6. INCHAR
886 0385' 68 86 +
887 0387' 0181' +
888 0389' 07 LDW CPAGE
889 038A' FB 59 XRI 059H :IOR 'Y' IS IT YES?
890 038C' 3A 92' BNZ MOVRTW
891 038E' FF 00 CLRTH: SHI 00H :SET DF
892 SRET R6
893 0390' 68 96 +
894 0392' FC 00 MOVRTW: ADI 00H :CLEAR DF
895 SRET R6
896 0394' 68 96 +
897 ;
898 ;
899 ;*****? Memory routine *****
900 ;
901 0396' QUESTW: SCAL R6. IN4D
902 0398' 68 86 +
903 0398' 01A9' +
904 039A' 8D GLO RD
905 039B' 73 STID
906 039C' 9D GHI RD
907 039D' 73 STID
908 SCAL R6. IN4D
909 039E' 68 86 +
910 03A0' 01A9' +
911 03A2' 9D GHI RD
912 03A3' BE PHI RE
913 03A4' 8D GLO RD
914 03A5' AE PLO RE
915 03A6' 12 INC STACK
916 03A7' 42 LDA STACK
917 03A8' BD PHI RD
918 03A9' 02 LDW STACK
919 03AA' AD PLO RD
920 SCAL R6. DELAY2

MACRO-18 3.36 PAGE 1-20
SEA DUCT: SD05R9.MAC 16 SEP 85

921 03AB' 68 86 +
922 03AD' 019B' +
923 03AF' 82 OUTADR: SEX STACK
924 03B0' 8D GLO RD
925 03B1' 73 STD
926 03B2' 9D GHI RD
927 03B3' 73 STD
928 SCAL R6, TTY
929 03B4' 68 86 +
930 03B6' 024E' +
931 03B8' CA DB OCAB
932 03B9' 81 DB 081H ;TYPE: CR.LF
933 03BA' 81 DB 081H
934 03BB' 20 DB 020H ; OUT HEX PR 12. SPACE
935 03BC' FF DB DONE ; DONE
936 03BD' 12 INC STACK
937 03BE' 42 LDA STACK
938 03BF' BD PBI RD
939 03C0' 02 LDW STACK
940 03C1' AD PLO RD
941 03C2' 8E MEKBYT: GLO RE
942 03C3' 3A C9' BNZ DECCT
943 03C5' 9E GHI RE
944 03C6' C2 0107' LBZ PROMPT
945 03C9' 2E DECCT: DEC RE
946 SCAL R6, TTY
947 03CA' 68 86 +
948 03CC' 024E' +
949 03CE' 8DFF DW 8DFFH ;TYPE: OUT HEX RD. DONE
950 03D0' 8D GLO RD
951 03D1' 2A 02 AMI 00FH ;MASK FOR LINE LENGTH
952 03D3' C2 03B3' LBZ LNTEST ; 07 = 08H / LINE
953 03D6' 2A 01 AMI 01H ; 0F = 10H / LINE
954 03D8' 3A C2' BNZ MEKBYT
955 SCAL R6, TTY
956 03DA' 68 86 +
957 03DC' 024E' +
958 03DE' 20FF DW 20FFH ;TYPE: SPACE, DONE
959 03E0' C0 03C2' LBR MEKBYT
960 :
961 03E3' 8E LNTEST: GLO RE ;TEST FOR END OF LINE
962 03E4' 3A EC' BNZ LNEND
963 03E6' 9E GHI RE
964 03E7' 3A EC' BNZ LNEND
965 03E9' C0 0107' LBR PROMPT
966 :

MACRO-18 3.36 PAGE 1-21
SEA DUCT: SD05R9.MAC 16 SEP 86

957 03EC' ;
958 03EC' 68 86 ;
959 03EE' 024E' ;
970 03F0' 3BFF DW 3BFFH
971 03F2' C0 03AF' LBR OUTADR
972 ;
973 ;
974 ;***** ! Memory routine *****
975 ;
976 03F5' F8 03 WRITEM: LD1 SYSPLG
977 03F7' A7 PLO GPAGE
978 03F8' 01 LDW GPAGE
979 03F9' FA 40 ANI 40H ;CHECK FOR UNLOCK FLAG
980 03FA' C2 035D' LDZ SAYNO
981 03FB' ;INADDR: SCAL R6. IN4D
982 03F2' 68 86 ;
983 0400' 01A9' ;
984 0402' 9D SH1 RD
985 0403' BE PHI RE
986 0404' 8D GLO RD
987 0405' AE PLO RE
988 0405' ;INIST: SCAL R6. INCBAR
989 0405' 68 86 ;
990 0408' 0181' ;
991 040A' 07 LDW GPAGE
992 040B' 32 36' B2 INIST ;IGNORE NULLS
993 ; SCAL R6. ASCHBX
994 040D' 68 36 ;
995 040E' 01C8' ;
996 0411' C3 0437' LDDF TESTSP ;DP = NOT SEA
997 0414' 07 LDW GPAGE
998 0415' AD PLO RD ;SAVE TO DIGIT
999 0416' ;IN2ND: SCAL R6. INCBAR
1000 0415' 68 36 ;
1001 0418' 0181' ;
1002 ; SCAL R6. ASCHBX
1003 041A' 68 36 ;
1004 041C' 01C8' ;
1005 041E' 33 39' ADC ERROR!
1006 ; SCAL R6. SFTD4
1007 0420' 68 86 ;
1008 0422' 018P' ;
1009 0424' 8D GLO RD
1010 0425' 58 STR RS ;WRITE INTO RAM
1011 0426' 18 INC RE
1012 0427' 30 36' BR IN157

MACRO-18 3.36 PAGE 1-22
SEA DUCT: SD05R9.MAC 16 SEP 86

1013 0429' :
1014 0429' 68 86 :
1015 042B' 019B' :
1016 : SCAL R6. DELAY2
1017 042D' 68 86 :
1018 042F' 0248' :
1019 0431' 3F3F : DW 3F3F ; ?, ?
1020 0433' FF : DB DONE ; DONE
1021 0434' C0 0107' : LBR PROMPT
1022 0437' 07 : TESTSP: LDW GPAGE
1023 0438' FB 20 : XRI 20H ; ' ' XOR 'SPACE' IS IT 'SPACE'?
1024 043A' C2 0406' : LBZ INIST
1025 043D' FB 0C : XRI 0CH ; ',' XOR SPACE IS IT ','?
1026 043F' CA 0449' : LBWZ SEMI?
1027 : SCAL R6. PASSCA
1028 0442' 68 86 :
1029 0444' 045B' :
1030 0446' C0 0406' : LBR INIST
1031 0449' FB 17 : SEMI?: XRI 017H ; ';' XOR ',' IS IT ';'?
1032 044B' 3A 54' : BNZ TESTCR
1033 : SCAL R6. PASSCA
1034 044D' 68 86 :
1035 044F' 0452' :
1036 0451' C0 03FF' : LBR INADDR
1037 :
1038 0454' FB 36 : TESTCR: XRI 036H ; 'CR' XOR ';' IS IT 'CR'?
1039 0456' CA 0429' : LBWZ ERROR1
1040 0459' FC 00 : ADI 00H ; CLEAR OF
1041 045B' C0 0107' : LBR PROMPT
1042 :
1043 045B' : PASSCA: SCAL R6. INCHAR ; ONLY USED BY .S
1044 045B' 68 86 :
1045 0460' 0181' :
1046 0462' 07 : LDW GPAGE
1047 0463' FB 00 : XRI 0DH ; IS IT 'CR'?
1048 0465' 3A 58' : BNZ PASSCA
1049 0467' : INLP: SCAL R6. INCHAR
1050 0467' 68 86 :
1051 0469' 0181' :
1052 046B' 07 : LDW GPAGE
1053 046C' FB 0A : XRI 0AH ; IS IT 'LF'?
1054 046E' 3A 67' : BNZ INLP
1055 : SRET R6
1056 0470' 68 96 :
1057 :
1058 :

MACRO-18 3.36 PAGE 1-23
SEA DUCT: SD05R9.MAC 16 SEP 86

1059 ;***** S P (RUNS PROGRAM AT AAAA *****
1060 ; WITH PC = R3, I = R2)
1061 ;
1062 0472' F8 03 TESTS: LDI SYSPLG
1063 0474' A7 PLO GPAGE
1064 0475' 07 LDW GPAGE
1065 0476' FA E0 AMI OEOH :MASK FOR ADDR, WRITE, SYS FLAGS
1066 0478' FB E0 XRI OEOH :ADDR = WRITE = SYS = 1 ?
1067 047A' CA 035D' LBNZ SAYNO
1068 047B' DOLIN: SCAL R6, IN4D
1069 047C' 68 86 +
1070 047E' 01A9' +
1071 0481' 90 GHI RD
1072 0482' 3E PHI RE
1073 0483' 3D GLO RD
1074 0484' AE PLO RE
1075 SCAL R6, TTY
1076 0485' 68 86 +
1077 0487' 0248' +
1078 0489' CA81 DW 0CA81H :TYPE: SPACE.
1079 048B' 812C DW 812CH : OUT HEX PR .'
1080 048D' FF DB DONE : DONE
1081 SCAL R6, TESTOK
1082 048E' 68 86 +
1083 0490' 036F' +
1084 0492' CB 0107' LBNP PROMPT
1085 0495' 82 SEX STACK :I => R2
1086 0496' 36 GLO R6
1087 0497' 73 STD
1088 0498' 96 GHI R6
1089 0499' 73 STD
1090 049A' 98 PHI R6
1091 049B' 36 GLO R6
1092 049C' 8E PLO R6
1093 049D' 16 ADI 00 :CLEAR DF
1094 049E' FC 00 RET 16
1095 04A0' 68 95 +
1096 ;
1097 ;
1098 ;
1099 ;***** CRC CALCULATION *****
1100 ;
1101 04A2' CRC: SCAL R6, TTY :TYPE:
1102 04A2' 68 86 +
1103 04A4' 0248' +
1104 04A6' 52 43 20 DB 'RC' : RC from.

MACRO-18 3.36 PAGE 1-24
SEA DUCT: SD05R9.MAC 16 SEP 86

1105	04A9'	66 72 6F 6D	DB 'from '	:	ETI.
1106	04AD'	20			
1107	04AB'	03	DB ETX	:	IN4D.
1108	04AF'	9DEF	DW 9DFFH	:	DONE
1109	04B1'	9D	GHI RD		
1110	04B2'	BE	PHI RE		
1111	04B3'	8D	GLO RD		
1112	04B4'	AE	PLO RE		
1113			SCAL R6. TTY	:	TYPE:
1114	04B5'	58 86	+		
1115	04B7'	0248'	+		
1116	04B9'	6F 76 65 72	DB 'over '	:	over.
1117	04BD'	20			
1118	04BE'	03	DB ETX	:	ETI.
1119	04BF'	9D	DB 09DH	:	IN4D.
1120	04C0'	FF	DB DONE	:	DONE
1121	04C1'	F8 07	LDI CIRCLO		
1122	04C3'	A7	PLO GPAGE		
1123	04C4'	F8 00	LDI 00H		
1124	04C6'	BC	PHI RC	:	CLEAR "ALL FF'S" FLAG
1125	04C7'	57	STR GPAGE		
1126	04C8'	27	DEC GPAGE	:	SET CRC HI & LO = 0000
1127	04C9'	57	STR GPAGE		
1128	04CA'	08	CLOOP1: LDW RE		
1129	04CB'	FB FF	IPI OFFH		
1130	04CD'	CE	LSZ		
1131	04CE'	BC	PHI RC		
1132	04CF'	E2	SEX STACK	:	A NOP
1133			SCAL R6. CRCSUB		
1134	04D0'	58 86	+		
1135	04D2'	050E'	+		
1136	04D4'	2D	DEC RD		
1137	04D5'	8D	GLO RD		
1138	04D6'	3A CA'	BWZ CLOOP1		
1139	04D8'	9D	GHI RD		
1140	04D9'	CA 04CA'	LBWZ CLOOP1		
1141	04DC'	9C	GHI RC		
1142	04DD'	C2 04F5'	LBZ SAYCLR	:	IS MEMORY SPACE EMPTY ?
1143	04E0'	97	GHI GPAGE		
1144	04E1'	BD	PHI RD		
1145	04E2'	87	GLO GPAGE		
1146	04E3'	AD	PLO RD	:	
1147			SCAL R6. TTY	:	IF NOT. TYPE:
1148	04E4'	58 86	+		
1149	04E6'	0248'	+		
1150	04E8'	CA	DB OCAM	:	CR. 07

MACRO-18 3.16 PAGE 1-25
SEA DUCT: SD05R9.MAC 16 SEP 86

1151 04E9' 43 52 43 20 DB 'CRC = ' ; CRC =
1152 04ED' 3D 20
1153 04F2' 898D DW 8D8DH ; OUT VID RD X2
1154 04F1' FF DB DONE ; DONE
1155 04F2' C0 0107' LBR PROMPT
1156 04F5' SAYCLR: SCAL 26. TTY ; IF CLEAR, TYPE: CR, LF, NULL X6
1157 04F5' 68 86 +
1158 04F7' 024E' +
1159 04F9' CA DB OCAN ; Memory is clear
1160 04FA' 4D 55 6D 6F DB 'Memory'
1161 04FE' 72 79 20
1162 0501' 69 73 20 63 DB 'is clear.'
1163 0505' 6C 65 61 72
1164 0509' 2E
1165 050A' FF DB DONE ; DONE
1166 050B' C0 0107' LBR PROMPT ; GO TO PROMPT
1167 :
1168 :
1169 0508' E7 CRCSUB: SEX GPAGE ; CRC CALCULATION SUBROUTINE
1170 050F' 48 LDA R2 ; SEE BRADLEY CRC WRITEUP
1171 0510' F3 IOR
1172 0511' 27 DEC GPAGE
1173 0512' 57 STR GPAGE
1174 0513' F6 SHR
1175 0514' F6 SHR
1176 0515' F6 SHR
1177 0516' F6 SHR
1178 0517' F3 IOR
1179 0518' 57 STR GPAGE
1180 0519' F8 SHL
1181 051A' F8 SHL
1182 051B' F8 SHL
1183 051C' F8 SHL
1184 051D' 60 IRX
1185 051E' 60 IRX
1186 051F' F3 IOR
1187 0520' 27 DEC GPAGE
1188 0521' 73 STAD
1189 0522' 72 LDIA
1190 0523' F6 SHR
1191 0524' F6 SHR
1192 0525' F6 SHR
1193 0526' F3 IOR
1194 0527' 73 STAD
1195 0528' F0 LDIA
1196 0529' F2 SHL

MACRO-18 3.36 PAGE 1-26
SEA DUCT: SD05R9.MAC 16 SEP 86

1197 052A' PE SHL
1198 052B' PE SHL
1199 052C' PE SHL
1200 052D' PE SHL
1201 052E' F3 IOR
1202 052F' 60 IRX
1203 0530' 60 IRX
1204 0531' 73 STID
1205 0532' E2 SEX STACK
1206 SRST R6
1207 0533' 68 95 +
1208 ;
1209 ;
1210 ;***** ! TIME *****
1211 ;
1212 ;
1213 0535' TINEST: SCAL R6, INKWD ;LOOK FOR:
1214 0535' 68 86 +
1215 0537' 0208' +
1216 0539' 49 4D 45 DB 'IME' ; IME
1217 053C' PE DB DONE ; DONE
1218 053D' 0542' DW CLRBUF
1219 053F' C0 0107' LBR PROMPT
1220 0542' 97 CLRBUF: GHI GPAGE
1221 0543' 98 PHI RE
1222 0544' F8 20 LDI BUP9 ;GPAGE = 9 DIGIT INPUT BUFFER
1223 0546' 52 STR STACK
1224 0547' AX PLO RE
1225 0548' F8 00 CLR: LDI OOR ;CLEAR 9 DIGIT BUFFER
1226 054A' 58 STR RE
1227 054B' 12 INC RE
1228 054C' 88 GLO RE
1229 054D' F8 09 SMI 09H
1230 054F' E2 SEX STACK
1231 0550' F3 IOR ;9 PAST END ?
1232 0551' CA 0548' LBWZ CLR
1233 0554' 02 SETTOP: LDW STACK
1234 0555' AX PLO RE
1235 0556' 22 INPUT: DEC STACK
1236 SCAL R6, INTIME
1237 0557' 68 86 +
1238 0559' 05AC' +
1239 055B' 12 INC STACK
1240 055C' 07 LDW GPAGE
1241 055D' F8 40 XOR 40H ;XOR '0' IS IT AN 0 ?
1242 055F' 32 7B' BZ TIMEJN

MACRO-18 3.36 PAGE 1-27
 SEA DUCT: SD05R9.MAC 16 SEP 86

1243	0561'	07	LDW GPAGE
1244	0562'	FF 30	SMI 010H :IGNORE NON-DECIMAL
1245	0564'	CB 0556'	LBNP INPUT
1246	0567'	FF 0A	SMI 0AH
1247	0569'	C3 0556'	LBDF INPUT
1248	056C'	PC 0A	KEEP1: ADI 0AH
1249	056E'	5E	STR RE
1250	056F'	1E	INC RE
1251	0570'	8E	GLO RE
1252	0571'	FF 09	SMI 09H
1253	0573'	E2	SEX STACK
1254	0574'	E3	IOR
1255	0575'	C2 0554'	BLZ SETTOP
1256	0578'	C0 0556'	LDR INPUT
1257			:
1258			:
1259	057B'	E3	TIMEJM: SEX PC :DISABLE INTERRUPTS
1260	057C'	71	DIS
1261	057D'	33	DB 33H
1262	057E'	02	LDW STACK
1263	057F'	FF 10	SMI 10H
1264	0581'	A7	PLO GPAGE :NOW AT DAYS 1100
1265	0582'	88	TIMEIM: GLO RE : PREVIOUSLY CALLED COPYLOOP
1266	0583'	FF 09	SMI 09H
1267	0585'	E2	SEX STACK
1268	0586'	E3	IOR
1269	0587'	3A 83'	BLZ COPY
1270	0589'	02	LDW STACK
1271	058A'	4E	PLO RE
1272	058B'	48	COPY: LDA RE
1273	058C'	57	STR GPAGE
1274	058D'	17	INC GPAGE
1275	058E'	87	GLO GPAGE
1276	058F'	PC 07	ADI 07H
1277	0591'	E3	IOR
1278	0592'	3A 82'	BLZ TIMEIM
1279	0594'	F8 01	LDI 01 :TIME CORRECTION FOR LOADING
1280	0595'	57	STR GPAGE
1281	0597'	02	LDW STACK
1282	0598'	PC 02	ADI 02
1283	059A'	A7	PLO GPAGE
1284	059B'	F8 00	LDI 00
1285	059D'	87	SEX GPAGE
1286	059E'	73	STD
1287	059F'	73	STD
1288	05A0'	F8 01	LDI 01

MACRO-18 3.35 PAGE 1-28
SEA DUCT: SD05R9.MAC 16 SEP 86

1289 05A2' 57 STR GPAGE
1290 05A3' C8 LSRP ;LBR TO PINETRIM CAN BE /INSERTED HERE
1291 05A4' FFFF DW 0FFFFH
1292 05A6' 83 START2: SEX PC ;IS NOT INCLUDED IN THIS SYSTEM
1293 05A7' 70 RET
1294 05A8' 33 DB 33H ;ENABLE INTERRUPT
1295 05A9' C0 00B4' LBR UNADD
1296 :
1297 :
1298 :***** INPUT TIME *****
1299 :
1300 05AC' 68 INTIME: INP STAT1 ;CHECK FOR DA
1301 05AD' F6 SHR
1302 05AE' 3B AC' BMF INTIME ;WAIT FOR DA
1303 05B0' FA 06 ANI 06H ;CHECK FOR PE AND PE
1304 05B2' 32 B7' B2 KEEPT
1305 05B4' 6A INP DATA1 ;CLEAR BAD DATA
1306 05B5' 30 AC' BR INTIME
1307 05B7' F8 FE KEEPT: LDI YOLOC
1308 05B9' A7 PLO GPAGE
1309 05BA' E7 SEX GPAGE
1310 05BB' 6A INP DATA1
1311 05BC' FA 7F ANI 07FH ;MASK MSB
1312 05BE' 57 STR GPAGE
1313 05BF' C0 019B' LBR DELAY2
1314 :
1315 :
1316 :***** / TIME *****
1317 :
1318 :
1319 05C2' QUESTT: SCAL R6, TTY ;TYPE:
1320 05C2' 68 86 +
1321 05C4' 024E' +
1322 05C6' 2E 1E 2E 20 DB '... ' ; ... DONE
1323 05C8' FF DB DONE
1324 05CB' F8 18 LDI SEC1
1325 05CD' A7 PLO GPAGE
1326 05CE' 07 WAIT1: LDB GPAGE ;WAIT FOR SEC = 00
1327 05CF' 31 CE' BMZ WAIT1
1328 05D1' 87 GLO GPAGE
1329 05D2' FF 08 SMI 08H ;MOVE GPAGE TO D I 100
1330 05D4' AD PLO RD
1331 05D5' 97 GHI GPAGE
1332 05D6' BD PHI RD ;SET R(D) = GPAGE DX100
1333 :SCAL R6, TTY ;TYPE:
1334 05D7' 68 86 +

MACRO-18 3.36 PAGE 1-29
SEA DUCT: SD05R9.MAC 16 SEP 86

1335	05D9'	024E'	+		
1336	05DB'	20DD		DW 0200DH	; DCD 8H MM SS Z
1337	05DD'	DDDD		DW 0BDDDH	; ...
1338	05DF'	20DD		DW 0200DH	
1339	05E1'	DD		DB 0DDH	
1340	05E2'	3ADD		DW 03ADDR	
1341	05E4'	DD20		DW 0DD20H	
1342	05E6'	DD		DB 0DDH	
1343	05E7'	35 20 5A 2E		DB '5 Z... '	
1344	05EB'	2E 2E 20			
1345	05EE'	FF		DB DONE	
1346	05EF'	8D		GLO RD	
1347	05F0'	FC 06		ADI 06H	
1348	05F2'	AD		PLO RD	
1349	05F3'	5D		STR RD	
1350	05F4'	FF 06		SMI 06H	
1351	05F6'	A7		PLO GPAGE	
1352	05F7'	07		WAIT2: LDW GPAGE	
1353	05F8'	FB 06		XRI 06H	
1354	05FA'	CA 05P7'		LBNZ WAIT2	
1355	05FD'	FC 00		ADI 00H	:CLEAR OF
1356	05FF'	CO 0107'		LBR PROMPT	
1357			:		
1358			:		
1359			:	***** : SEQUENCER *****	
1360			:		
1361	0602'			SEQSET: SCAL R6. TTY	:TYPE:
1362	0602'	58 86	+		
1363	0604'	0248'	+		
1364	0606'	65 71 75 65		DB 'equencer'	; equencer On ?
1365	060A'	6E 63 65 72			
1366	060E'	20 4F 6E 20		DB ' On ? '	; ETX
1367	0612'	3F 20			
1368	0614'	03FF		DW 03FFH	; DONE
1369				SCAL R6. TESTY	
1370	0616'	58 86	+		
1371	0618'	0380'	+		
1372	061A'	33 32'		BDF SETPC	:IS IT Yes ?
1373	061C'	F8 07'		LDI HIGH(IDLLOC)	:IF NOT GO TO IDLE LOOP
1374	061E'	BD		PBI RD	
1375	061F'	F8 00'		LDI LOW(IDLLOC)	
1376	0621'	AD		PLO RD	
1377	0622'	F8 50		SETPPC: LDI PPCHI	:START PSUEDO PROGRAM
1378	0624'	A7		PLO GPAGE	
1379	0625'	B3		SEX PC	
1380	0626'	71		DIS	

MACRO-18 3.36 PAGE 1-30
SEA DUCT: SD05R9.MAC 16 SEP 86

1381 0627' 33 DB 33H ;DISABLE INTERRUPT
1382 0628' 9D GHI RD
1383 0629' 57 STR GPAGE
1384 062A' 17 INC GPAGE
1385 062B' 8D GLO RD
1386 062C' 57 STR GPAGE
1387 062D' 70 RET
1388 062E' 33 DB 33H ;ENABLE INTERRUPT
1389 062F' C0 0107' LBR PROMPT
1390 ;
1391 ;
1392 0632' SETPC: SCAL R6. TTY ;TYPE:
1393 0632' 68 86 +
1394 0634' 024E' +
1395 0635' 20 61 74 20 DB ' at PPC = ' ; at PPC =
1396 0638' 50 50 43 20
1397 0638' 3D 20
1398 0640' 03 DB ETX ; ETX
1399 0641' 9DFF DW 9DFFH ; IN4D, DONE
1400 0643' 8D GLO RD
1401 0644' 1E PLO RE
1402 0645' 9D GHI RD
1403 0646' BE PHI RE
1404 ;
1405 0647' 32 50' BZ PCSAME ;If the entered PPC = SPACE or 00xx.
1406 ; ; the current PPC will continue.
1407 ;
1408 SCAL R6. TTY
1409 0649' 68 86 +
1410 064B' 024E' +
1411 064D' CA81 DW 0CA81H ;TYPE: SPACE.
1412 064F' 812C DW 812CH ; OUT HEX PR '.'
1413 0651' FF DB DONE ; DONE
1414 SCAL R6. TESTOK
1415 0652' 68 86 +
1416 0654' 036F' +
1417 0656' 3B 7B' BUP SET2ND
1418 0658' 9E GHI RE
1419 0659' 8D PHI RD
1420 065A' 8E GLO RE
1421 065B' AD PLO RD
1422 065C' FC 00 ADI 00 ;CLEAR DF
1423 065E' 30 22' BR SETPPC
1424 ;
1425 0660' PCSAME: SCAL R6. TTY ;TYPE:
1426 0660' 68 86 +

MACRO-18 3.36 PAGE 1-31
SEA DUCT: SD05R9.MAC 15 SEP 86

1427 0662' 024E' +
1428 0664' C1 DB OCAB : CR.LF
1429 0665' 43 6F 6B 74 DB 'Continue ? ': Continue
1430 0669' 69 6B 75 65
1431 066D' 20 3F 20
1432 0670' 03 DB ETX
1433 0671' FF DB DONE
1434 SCAL R6. TESTY :IS THE RESPONSE 'Y'
1435 0672' 68 36 +
1436 0674' 0380' +
1437 0676' 3B 7B' BPF SET2ND :If not 'Y', try again
1438 0678' C0 0107' LBR PROMPT :IF 'Y' (Continue w/ same PPC), go to Prompt
1439 :
1440 067B' SET2ND: SCAL R6. TTY
1441 067B' 68 36 +
1442 067D' 024E' +
1443 067E' C1A53 DW OCAS3H :TYPE: CR.LF.'S'
1444 0681' FF DB DONE : DONE
1445 0682' 30 02' BR SEQSET
1446 :
1447 :
1448 :***** : SEQUENCER *****:
1449 :
1450 0684' 97 SEQ?: GHI SPAGE
1451 0685' BD PHI RD
1452 0686' 28 60 LDI PPCHI
1453 0688' BD PLO RD
1454 SCAL R6. TTY :TYPE:
1455 0689' 68 36 +
1456 068B' 024E' +
1457 068D' 65 71 75 65 DB 'equencer' : equencer
1458 0691' 6B 63 65 72
1459 0695' 20
1460 0695' 50 50 43 30 DB 'PPC = ' : PPC =
1461 069A' 3D 30
1462 069C' 8D8D DW 8D8DH : OUT IX PR M(RD) I2
1463 069E' 20 20 52 73 DB ' Rstck = ' : Rstck =
1464 06A2' 74 6B 20 3D
1465 06A6' 20
1466 06A7' 8D8D DW 8D8DH : OUT IX PR M(RD) I2
1467 06A9' 20 20 41 73 DB ' Astck = ' : Astck =
1468 06AD' 74 6B 20 3D
1469 06B1' 20
1470 06B2' 8D8D DW 8D8DH : OUT IX PR M(RD) I2
1471 06B4' 20 20 DB '' :
1472 06B6' FF DB DONE :DONE

MACRO-18 3.36 PAGE 1-32
SEA DUCT: SD05R9.MAC 16 SEP 86

1473 06B7' F8 64 LDI ASTKHI
1474 06B9' A7 PLO GPAGE
1475 06BA' 47 LDA GPAGE
1476 06BB' BD PHI RD
1477 06BC' 07 LDW GPAGE
1478 06BD' AD PLO RD
1479 06BE' 8D SEQ?EX: GLO RD
1480 06BF' FA 0F AMI OFH
1481 06C1' FB 0F XRI OFH
1482 06C3' C2 0107' LBZ PROMPT
1483 06C6' 58 86 SCAL R6, TTY ;TYPE:
1484 06C8' 024E' +
1485 06CA' 3020 DW 8D20H ; OUT EX PR M(RD)
1486 06CC' FF DB DONE ;DONE
1487 06CD' 30 BB' BR SEQ?EX
1488 ;
1489 ;
1490 ;*****
1491 ;
1492 ;***** SEQUENCER IDLE LOOP *****
1493 ;
1494 ;
1495 ; ORG (HDSTRT + 700H) ; DO NOT MOVE !
1496 ;
1497 ;***** SEQUENCER IDLE LOOP (PSUEDO OP CODES - NOT 1806 CODE ..
1498 ;
1499 0700' 4D28 IDLLOC: DW 4D28H ;INITIALIZE SEQUENCER 4D = INIT STK & CTIS
1500 0702' 0700' DW IDLLOC ;GO TO IDLLOC 38 = GOTO
1501 ;
1502 ;
1503 ;*****
1504 ;
1505 ;
1506 ;***** ! FOLLOW PPC (PPCSHO) *****
1507 ;
1508 ;
1509 ; FOLLOW PPC CAN ONLY BE STOPPED
; BY BREAKING THE LOOP AND READDRESSING
1510 ;
1511 0704' PPCSHO: SCAL R6, TTY ;TYPE:
1512 0704' 58 86 +
1513 0706' 024E' +
1514 0708' 68 6C 5C 6F DB 'allow' ; allow PPC
1515 070C' 77
1516 070D' 20 50 50 43 DB ' PPC'
1517 0711' CAPP DW 0CAF0H ; CL. OF. DONE
1518 0713' F8 60 REPORT: LDI PPCHI

MACRO-18 3.36 PAGE 1-33
SEA DUCT: SD05R9.MAC 16 SEP 86

1519	0715'	AD	PLO RD
1520	0716'	97	GHI GPAGE
1521	0717'	BD	PHI RD
1522	0718'	B2	SEX STACK
1523			SCAL R6. TTY :TYPE:
1524	0719'	68 86	+ DW 8D8DH : OUT VIA M(R(D)) I 2
1525	0718'	0248'	+ DB '' : . . . DONE
1526	071D'	8D8D	DB DONE : DEC RD
1527	071F'	20	DEC RD :POINT TO PPCHI
1528	0720'	PF	LDA RD
1529	0721'	2D	PHI RC
1530	0722'	2D	LDW RD
1531	0723'	4D	PLO RC
1532	0724'	8C	PPCCMP: SEX RD :COMPARE WITH OLD PPC
1533	0725'	9D	DEC RD :TYPE NEW PPC WHEN IT APPEARS
1534	0726'	AC	GHI RC
1535	0727'	ED	IOR
1536	0728'	2D	BMZ REPORT
1537	0729'	9C	INC RD
1538	072A'	F3	GLG RC
1539	072B'	3A 13'	IOR
1540	072D'	1D	BMZ REPORT
1541	072E'	8C	INC RD
1542	072F'	F3	GLG RC
1543	0730'	3A 13'	IOR
1544	0732'	30 27'	BMZ REPORT
1545			BR PPCCMP
1546			:
1547			*****
1548			*****
1549			***** MEMORY PROTECT AND ENABLE *****
1550			:
1551	0734'		MEMSAV: SCAL R6. TTY :TYPE: 'text'
1552	0734'	68 86	+ DB 'emory - '
1553	0735'	0248'	+ DB 'Protect or Enable'
1554	0738'	55 6D 6P 72	DB 'Protect or Enable'
1555	073C'	79 20 2D 20	DB 'Protect or Enable'
1556	0740'	50 72 6P 74	DB 'Protect or Enable'
1557	0744'	55 63 74 20	DB 'Protect or Enable'
1558	0748'	6P 72 20 45	DB 'Protect or Enable'
1559	074C'	6E 61 52 6C	DB 'Protect or Enable'
1560	0750'	55	DB 'Protect or Enable' ?
1561	0751'	10 28 50 20	DB 'Protect or Enable' ?
1562	0755'	6P 72 20 45	DB ETX
1563	0759'	29 20 3P 20	
1564	075D'	03	

MACRO-18 3.36 PAGE 1-34
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

1565 0758' FF          DB DONE
1566                               ;
1567                               SCAL R6. TSRE?
1568 075P' 68 86          +
1569 0761' 02F0'          +
1570                               SCAL R6. ITB      ;CALL INPUT TEST AND BRANCH
1571 0753' 68 86          +
1572 0765' 022B'          +
1573 0767' 50              DB 'P'           ; IF P, GO TO PTCT
1574 0768' 0779'          DW PTCT
1575 076A' 45              DB 'E'           ; IF E, GO TO ENABLE
1576 076B' 0771'          DW ENABLE
1577 076D' FF              DB DONE
1578 076E' C0 0107'        LBR PROMPT     ;GO TO PROMPT IF NOT P OR E
1579                               ;
1580 0771' F8 00          ENABLE: LDI 00
1581 0773' BB              PHI RB
1582 0774' F8 01          LDI 01
1583 0776' AB              PLO RB      ;SET PROTECT FLAG
1584 0777' 30 7D'          BR SETPG
1585 0779' F8 00          PTCT: LDI 00
1586 077B' AB              PLO RB
1587 077C' BB              PHI RB      ;SET ENABLE
1588 077D'                 SETPG: SCAL R6. TTY  ;TYPE: CR, LF, 'text'
1589 077D' 68 36          +
1590 077F' 024E'          +
1591 0781' CA              DB OCAB
1592 0782' 46 72 5F 6D    DB 'from page '
1593 0786' 30 70 61 67
1594 078A' 65 20
1595 078C' 03              DB ETI         ; ETI
1596 078D' 9DFF             DW 9DFFH      ; IN4D. DONE
1597 078F' 80              GLO RD
1598 0790' BE              PHI RE      ;SET CURRENT PAGE
1599                               SCAL R6. TTY
1600 0791' 68 86          +
1601 0793' 024E'          +
1602 0795' 67 76 65 72    DB 'over '   ;TYPE: (text)
1603 0799' 20
1604 079A' 03              DB ETI         ; ETI
1605 079B' 9D              DB 09DH      ; IN4D.
1606 079C' 20 70 61 67    DB ' pages.' ; pages..
1607 07A0' 65 73 2E
1608 07A3' 00FF             DW DONE      ; DONE
1609 07A5' 8D              GLO RD
1610 07A6' AC              PLO RC
  
```

MACRO-18 3.36 PAGE 1-35
SEA DUCT: SD05R9.MAC 16 SEP 86

1611 07A7' C6 LSMZ
1612 07A8' FC 01 ADI 01
1613 07AA' AC PLO RC
1614 SCAL R6. MEMCHG
1615 07AB' 68 86 +
1616 07AD' 07B8' +
1617 07AF' C0 0107' LBR PROMPT
1618 ;
1619 ;
1620 ;***** MEMORY PROTECT OR ENABLE SUBROUTINE *****
1621 ;
1622 ;
1623 07B2' 46 MEMSUB: LDA LIST ;PASS ENABLE BIT
1624 07B3' AB PLO RB
1625 07B4' 46 LDA LIST ;PASS START PAGE
1626 07B5' BE PHI RE
1627 07B6' 46 LDA LIST ;PASS # OF PAGES
1628 07B7' AC PLO RC
1629 ;
1630 07B8' F8 0A MEMCHG: LDI GRPSAV ;SELECT SYSTEM I/O GROUP
1631 07B9' A7 PLO GPAGE ; AND STORE ON GLOBAL PAGE
1632 07B8' F8 07 LDI SYSTEM
1633 07BD' 57 STR GPAGE
1634 07BE' E7 SEX GPAGE
1635 07BF' 61 OUT GROUP
1636 ;
1637 07C0' EE SEX RE
1638 07C1' 8C NEXTPG: GLO RC
1639 07C2' 32 EP' BZ MDONE
1640 ;
1641 07C4' 9E GHI RE ;ALWAYS ENABLE:
1642 07C5' FB 50 XRI GLOPG ; GLOBAL PAGE
1643 07C7' 32 B2' BZ SETQ
1644 ;
1645 07C9' 9E GHI RE
1646 07CA' FB 52 XRI SSTKPG ; SEQUENCER STACK PAGE
1647 07CC' 32 B2' BZ SETQ
1648 ;
1649 07CE' 9E GHI RE
1650 07CF' FB 53 XRI STKPG ; STACK PAGE
1651 07D1' 32 B2' BZ SETQ
1652 ;
1653 07D3' 9E GHI RE
1654 07D4' FB 5B XRI BUFPG ; BUFFER PAGE
1655 07D6' 32 B2' BZ SETQ
1656 ;

MACRO-18 3.36 PAGE 1-36

SEA DUCT: SD05R9.MAC 16 SEP 86

1657	07D8'	9E	GHI RE
1658	07D9'	F8 F8	XRI INTPG ; INTERRUPT CONTROLLER PAGE
1659	07DD'	32 E2'	BZ SETQ
1660	07DD'	8B	GLO RD
1661	07DE'	3A E2'	BNZ SETQ ;PROTECT OR ENABLE ?
1662	07E0'	7A	REQ ; PROTECT -> Q = 0
1663	07E1'	38	SIP
1664	07E2'	7B	SETQ: SEQ ; ENABLE -> Q = 1
1665	07E3'	67	OUT MEMORY ;I/O = MEM. PROTECT
1666	07E4'	7A	REQ
1667	07E5'	9E	GHI RE
1668	07E6'	FC 01	ADI 01
1669	07E8'	DE	PHI RE
1670	07E9'	8C	GLO RC
1671	07EA'	FF 01	SHI 01
1672	07EC'	AC	PLO RC
1673	07ED'	30 C1'	BR NEXTPG
1674			:
1675	07EP'	F8 01	MDONE: LDI GRPSAV ;SELECT UART I/O GROUP
1676	07F1'	A7	PLO GPAGE ; AND STORE ON GLOBAL PAGE
1677	07F2'	F8 06	LDI UARTS
1678	07F4'	57	STR GPAGE
1679	07F5'	E7	SEX GPAGE
1680	07F6'	61	OUT GROUP
1681	07F7'	E2	SEX STACK
1682			SEET R6
1683	07F8'	68 95	+
1684			:
1685			:
1686			:
1687			*****
1688			*****
1689			:
1690			ORG HDSTRT + 800H
1691			:
1692			***** 2ND. PROM STARTS HERE *****
1693			:
1694			:THIS SECTION INCLUDES:
1695			:
1696			: INTERRUPT HANDLING
1697			: REAL TIME CLOCK
1698			: BASIC SEQUENCER
1699			: LONG BRANCH TABLE
1700			: PASS THRU MODE
1701			: SEA DUCT SPECIFIC CODE
1702			:

MACRO-18 3.36
SEA DUCT: SD05R9.MAC

PAGE 1-37

16 SEP 86

1703 ;
1704 ;***** INTERRUPT VECTORS *****
1705 ;
1706 ;
1707 0800' C0 083F' INTPAGE: LDR INTPO ;INTERRUPT 0 VECTOR
1708 0803' C8 LSKP ;***
1709 0804' FFFF DW 0FFFFH ;
1710 0806' C8 LSIP ;
1711 0807' FFFF DW 0FFFFH ;
1712 0809' C8 LSKP ;
1713 080A' FFFF DW 0FFFFH ;
1714 080C' C8 LSKP ; FOR FUTURE VECTORS
1715 080D' FFFF DW 0FFFFH ;
1716 080F' C8 LSKP ;
1717 0810' FFFF DW 0FFFFH ;
1718 0812' C8 LSKP ;
1719 0813' FFFF DW 0FFFFH ;
1720 0815' C8 LSKP ;
1721 0816' FFFF DW 0FFFFH ;***
1722 ;
1723 ;
1724 ;
1725 ;***** RESTORE FROM INTERRUPT 0 *****
1726 ;
1727 ;***** NOTE! ~ MUST DIRECTLY PRECED INTERRUPT 0 *****
1728 ;
1729 0818' F8 50 RESTORE: LDI GLOPG ;RESET GPAGE(HI) JUST IN CASE
1730 081A' B7 PHI GPAGE
1731 081B' F8 0A LDI GRPSAV ;RESTORE I/O GROUP
1732 081D' A7 PLO GPAGE
1733 081E' B7 SEI GPAGE
1734 081F' 61 OUT GROUP
1735 0820' B2 SEI STACK ;SET X TO STACK = R2
1736 0821' 12 INC STACK
1737 0822' 72 LDIA
1738 0823' A7 PLO GPAGE ;RESTORE GLOBAL PAGE R7.0
1739 0824' 72 LDIA
1740 0825' B8 PHI RA ;RESTORE RA
1741 0826' 72 LDIA
1742 0827' AA PLO RA
1743 0828' 72 LDIA
1744 0829' BB PHI RB ;RESTORE RB
1745 082A' 72 LDIA
1746 082B' AB PLO RB
1747 082C' 72 LDIA
1748 082D' BC PHI RC ;RESTORE RC

MACRO-18 3.36 PAGE 1-38
SEA DUCT: SD05R9.MAC 16 SEP 86

1749	0828'	72	LDIA
1750	0829'	AC	PLO RC
1751	0830'	72	LDIA
1752	0831'	BD	PHI RD :RESTORE RD
1753	0832'	72	LDIA
1754	0833'	AD	PLO RD
1755	0834'	72	LDIA
1756	0835'	BE	PHI RE :RESTORE RE
1757	0836'	72	LDIA
1758	0837'	AB	PLO RE
1759	0838'	72	LDIA
1760	0839'	FE	SML :RESTORE DP
1761	083A'	72	LDIA :RESTORE D
1762	083B'	70	RET :RETURN
1763	083C'	C0 F880	LBR INTVEC
1764			:
1765			;***** INTERRUPT 0 *****
1766			:
1767	083F'	22	INTRPO: DEC STACK
1768	0840'	78	SAV :SAVE X.P
1769	0841'	22	DEC STACK
1770	0842'	73	STD :SAVE D
1771	0843'	76	SHRC
1772	0844'	73	STD :SAVE DF
1773	0845'	88	GLO RE
1774	0846'	73	STD :SAVE RE
1775	0847'	98	GHI RE
1776	0848'	73	STD
1777	0849'	8D	GLO RD
1778	084A'	73	STD :SAVE RD
1779	084B'	9D	GHI RD
1780	084C'	73	STD
1781	084D'	8C	GLO RC
1782	084E'	73	STD :SAVE RC
1783	084F'	9C	GHI RC
1784	0850'	73	STIR
1785	0851'	88	GLO RB
1786	0852'	73	STD :SAVE RB
1787	0853'	98	GHI RB
1788	0854'	73	STD
1789	0855'	8A	GLO RA
1790	0856'	73	STD :SAVE RA
1791	0857'	9A	GHI RA
1792	0858'	73	STD
1793	0859'	87	GLO GPAGE
1794	085A'	73	STD :SAVE GPAGE LOC. (R7.0)

MACRO-18 3.36
SEA DUCT: SD05R9.MAC 16 SEP 86

PAGE 1-39

1795 085B' 7B SEQ
1796 085C' 7A REQ ;PLUSE Q
1797 ;
1798 ;
1799 085D' F8 08 RBRET: LDI RBHI ;RESTORES RB USED IN THE LAST INTERRUPT
1800 085F' A7 PLO GPAGE
1801 0860' 47 LDA GPAGE
1802 0861' BB PHI RB
1803 0862' 07 LDW GPAGE
1804 0863' AB PLO RB
1805 ;
1806 ;
1807 ;***** LONG BRANCH TABLE *****
1808 ;
1809 0864' C0 08B1' LBT: LBR ATCHK ;@ CHECK
1810 0867' C0 0900' ATRTN: LBR RTC ;RUN REAL TIME CLOCK
1811 086A' C0 09CA' RTCRTN: LBR SEQCYC ;RUN SEQUENCER THIS CYCLE ? CYCLE > 0
1812 ;
1813 086D' C0 0A32' SEQRTN: LBR TTY2 ;SEND DATA ON LOOP 2 IF REQUIRED
1814 0870' C0 0A7D' TY2RTN: LBR BR2 ;BREAK LOOP 2 IF REQUIRED
1815 0873' C0 0A97' BR2RTN: LBR CTRCHK ;SEQUENCER CNTR(D) TIMEOUT? CYCLE = 26H
1816 ;
1817 0876' C0 12F0' CTRRTN: LBR CMPSRD ;READ COMPASS SEC. = X1; CYC = 0A,0B
1818 0879' C0 131A' CMPRTN: LBR SWRD ;READ SWITCHES SEC. = ALL; CYC = 24,25
1819 087C' C0 133F' SWRTN: LBR AD ;A/D, MUX CONTROL
1820 087F' C0 13BA' ADRTN: LBR TR ;TRANSMISSOMETER A/D CONTROL
1821 ;
1822 0882' C0 143B' TRRTN: LBR PDCHK ;RELAY PODS / ACOUSTIC LINK SEC = ALL, CYC = 27H
1823 0885' C0 1478' PDRTN: LBR HDGCHK ;HEADING INDICATOR CYC = 0B,0C
1824 0888' C0 14CA' HDGRTN: LBR PULCHK ;PULSE RELAY DRIVER?
1825 ;
1826 088B' C0 1500' PULRTN: LBR XYZCHK ;XYZ OPTO INTERRUPTERS FLG: 00=CYC 24,25
1827 ; AC=OPTO PWR. ON
1828 088E' C0 0DAD' XYZRTN: LBR SD ;SEA DATA BUFFER SETUP AND RECORD SEC. = 0; CYC = 1A
1829 0891' C8 SDRET: LSKP
1830 0892' FFFF DW OFFFFH
1831 ;
1832 ;
1833 0894' E2 RBSAVE: SEX STACK
1834 0895' F8 08 LDI RBHI ;SAVE RC FOR NEXT INTERRUPT
1835 0897' A7 PLO GPAGE
1836 0898' 9B GHI RB
1837 0899' 57 STR GPAGE
1838 089A' 17 INC GPAGE
1839 089B' BB GLO RB
1840 089C' 57 STR GPAGE

MACRO-18 3.36 PAGE 1-40
SEA DUCT: SD05R9.MAC 16 SEP 86

1841 ;
1842 ;
1843 089D' E1 BRCHK: SEX INTPC ;CHECK FOR SAIL BREAKS
1844 089E' 61 OUT GROUP
1845 089F' 06 DB UARTS ;UART GROUP X = INTERRUPT PC
1846 08A0' E2 SEX STACK ;CHECK FOR SAIL BREAK LOOP 2
1847 08A1' 6B INP STAT1 ;UART EXT STATUS LOOP 1 ?
1848 08A2' FA 10 ANI 10H
1849 08A4' 3A A8' BNZ BROKE
1850 08A6' 30 18' BR RESTRO
1851 ;
1852 08A8' F8 3F' BROKE: LDI LOW(RESTRT) ;SET PC = RESTRT
1853 08AA' A3 PLO PC
1854 08AB' F8 00' LDH HIGH(RESTRT)
1855 08AD' B3 PHI PC
1856 08AE' C0 001E' LBR SETSTK ;RESET STACK
1857 ;
1858 ;*****UART # CHECK *****
1859 ;
1860 ;
1861 08B1' F8 03 ATCHK: LDI SYSFLG ;CHECKS TO TYPE # FOR ?TIME
1862 08B3' A7 PLO GPAGE
1863 08B4' 07 LDN GPAGE
1864 08B5' F6 SHR
1865 08B6' 38 67' BNF ATRTN ;# FLAG SET ?
1866 08B8' 31 SEX INTPC
1867 08B9' 51 OUT GROUP
1868 08BA' 06 DB UARTS ;UART GROUP
1869 08BB' 62 OUT DATA1
1870 08BC' 40 DB '0' ;TYPE '0'
1871 08BD' 07 LDH GPAGE
1872 08BE' FA FE ANI OFEH
1873 08C0' 57 STR GPAGE ;CLEAR # FLAG
1874 08C1' 30 67' BR ATRTN ;RETURN TO LBT
1875 ;
1876 ;ORG (INTPGM + 100H)
1877 ;
1878 ;*****REAL TIME CLOCK *****
1879 ;
1880 ;
1881 ;
1882 0900' F8 1D RTC: LDI ARPLG
1883 0902' 52 STR STACK
1884 0903' A7 PLO GPAGE
1885 0904' 07 LDN GPAGE
1886 0905' 3A 2D' BNZ INCRTC

MACRO-18 3.36 PAGE 1-41
 SEA DUCT: SD05R9.MAC 16 SEP 86

1887	0907'	F8 03	DECAR: LDI 03H	;03 = 3 DIGIT LOOP COUNT
1888	0909'	A8	PLO CYCCNT	
1889	090A'	FC 00	ADI 00	;SET DF TO BORROW
1890	090C'	27	DECNEK: DEC GPAGE	
1891	090D'	07	LDN GPAGE	
1892	090E'	7F 00	SMBI 00	
1893	0910'	33 14'	BDF NOBRRW	
1894	0912'	F8 09	BORROW: LDI 09	
1895	0914'	57	NOBRRW: STR GPAGE	
1896	0915'	28	DEC CYCCNT	
1897	0916'	88	GLO CYCCNT	
1898	0917'	3A 0C'	BNZ DECNEK	
1899	0919'	F8 03	TESTO: LDI 03	;03 = 3 DIGIT LOOP COUNT
1900	091B'	A8	PLO CYCCNT	
1901	091C'	47	TSTNEK: LDA GPAGE	
1902	091D'	CA 086A'	LBNZ RTCRTN	
1903	0920'	28	DEC CYCCNT	
1904	0921'	88	GLO CYCCNT	
1905	0922'	3A 1C'	BNZ TSTNEK	
1906	0924'	F8 1D	CLRAR: LDI ARFLG	;SET A-R FLG. = NORM.
1907	0926'	A7	PLO GPAGE	
1908	0927'	F8 01	LDI 01	
1909	0929'	57	STR GPAGE	
1910	092A'	CO 086A'	LBR RTCRTN	
1911	092D'	F8 19	INCRTC: LDI CYCLES	;INCREMENT CYCLE COUNT
1912	092F'	A7	PLO GPAGE	
1913	0930'	07	LDN GPAGE	
1914	0931'	FC 01	ADI 01	
1915	0933'	57	STR GPAGE	
1916	0934'	FF 28	SMI HZ	;HZ = INTERRUPT RATE
1917	0936'	3B B4'	BNF TSTADV	
1918	0938'	F8 00	LDI 00	;CARRY CYCLES
1919	093A'	B7	SEX GPAGE	
1920	093B'	73	STXD	
1921	093C'	07	LDN GPAGE	
1922	093D'	FC 01	ADI 01	;INCREMENT SECONDS
1923	093F'	57	STR GPAGE	
1924	0940'	FF 0A	SMI OAH	
1925	0942'	33 5B'	BDF INC10	
1926	0944'	07	TEST5: LDN GPAGE	
1927	0945'	FB 05	XRI 05	;SECONDS = 5 ?
1928	0947'	3A B4'	BNZ TSTADV	
1929	0949'	F8 1E	LDI ATFLG	
1930	094B'	A7	PLO GPAGE	
1931	094C'	07	LDN GPAGE	
1932	094D'	32 B4'	BZ TSTADV	;RTC @ FLAG = 0 ?

MACRO-18 J.36 PAGE 1-42
 SEA DUCT: SD05R9.MAC 16 SEP 86

1933	094E'	F8 00	SETAT:	LDI 00	
1934	0951'	57		STR GPAGE	;CLEAR RTC @ FLAG
1935	0952'	F8 03		LDI SYSFLG	
1936	0954'	A7		PLO GPAGE	;SET SAIL @ FLAG
1937	0955'	07		LDN GPAGE	
1938	0956'	F9 01		ORI 01	
1939	0958'	57		STR GPAGE	
1940	0959'	30 B4'		BR TSTADV	
1941				;	
1942	095B'	F8 00	INC10:	LDI 00	;SET SEC X1 = 0
1943	095D'	73		STXD	;X = GPAGE HERE
1944	095E'	07		LDN GPAGE	;INC. SEC X 10
1945	095F'	FC 01		ADI 01	
1946	0961'	57		STR GPAGE	
1947	0962'	FF 06		SMI 06	;SEC X 10 = 6 ?
1948	0964'	3B B4'		BNF TSTADV	
1949	0966'	F8 00	INCMIN:	LDI 00	
1950	0968'	E7		SEX GPAGE	
1951	0969'	73		STXD	;CLEAR SEC X 10
1952	096A'	07		LDN GPAGE	
1953	096B'	FC 01		ADI 01	;INCREMENT MIN. X 1
1954	096D'	57		STR GPAGE	
1955	096E'	FF 0A		SMI 0A	
1956	0970'	3B B4'		BNF TSTADV	
1957	0972'	F8 00		LDI 00	
1958	0974'	73		STXD	
1959	0975'	07		LDN GPAGE	;MIN X 1 = 0, INC MIN X 10
1960	0976'	FC 01		ADI 01	
1961	0978'	57		STR GPAGE	
1962	0979'	FF 06		SMI 06	;HOUR UP ?
1963	097B'	3B B4'		BNF TSTADV	
1964	097D'	F8 00	HOURUP:	LDI 00	;CLEAR MIN X 10
1965	097F'	73		STXD	
1966	0980'	07		LDN GPAGE	
1967	0981'	FC 01		ADI 01	;INCREMENT HOURS
1968	0983'	73		STXD	
1969	0984'	FF 04		SMI 04	;HOURS X1 = 4 ?
1970	0986'	3B B4'		BNF TSTADV	
1971	0988'	07		LDN GPAGE	
1972	0989'	FF 02		SMI 02	;DAY UP ?
1973	098B'	33 9C'		BDP DAYUP	
1974	098D'	17	CHK10:	INC GPAGE	
1975	098E'	07		LDN GPAGE	
1976	098F'	FF 0A		SMI 0A	
1977	0991'	3B B4'		BNF TSTADV	
1978	0993'	F8 00		LDI 00	

MACRO-18 3.36

PAGE 1-43

SEA DUCT: SD05R9.MAC 16 SEP 86

1979	0995'	73	STXD
1980	0996'	07	LDN GPAGE
1981	0997'	FC 01	ADI 01 ;INC HOURS X 10
1982	0999'	57	STR GPAGE
1983	099A'	30 84'	BR TSTADV
1984		;	
1985	099C'	F8 00	DAYUP: LDI 00
1986	099E'	57	STR GPAGE
1987	099F'	17	INC GPAGE ;CLEAR HOURS
1988	09A0'	73	STXD
1989	09A1'	27	DEC GPAGE
1990	09A2'	F8 03	LDI 03
1991	09A4'	A8	PLO R8
1992	09A5'	07	DAYCAR: LDN GPAGE ;CARRY DAYS AS REQUIRED
1993	09A6'	FC 01	ADI 01
1994	09A8'	57	STR GPAGE
1995	09A9'	FF 0A	SMI OAH
1996	09AB'	3B 84'	BNF TSTADV
1997	09AD'	F8 00	LDI 00
1998	09AF'	73	STXD
1999	09B0'	28	DEC R8
2000	09B1'	88	GLO R8
2001	09B2'	3A A5'	BNZ DAYCAR
2002		;	
2003	09B4'	F8 1D	TSTADV: LDI ARFLG
2004	09B6'	A7	PLO GPAGE
2005	09B7'	07	LDN GPAGE
2006	09B8'	F8 02	XRI 02
2007	09BA'	3A C1'	BNZ TST2ND
2008	09BC'	F8 03	LDI 03
2009	09BE'	57	STR GPAGE
2010	09BF'	30 2D'	BR INCRTC
2011	09C1'	FB 01	TST2ND: XRI 01 ;01 = 02 OR 03
2012	09C3'	3A 24'	BNZ CLRAR
2013	09C5'	F8 02	LDI 02
2014	09C7'	57	STR GPAGE
2015	09C8'	30 07'	BR DECAR
2016		;	
2017		;	***** SEQUENCE CYCLE ? *****
2018		;	
2019		;	
2020	09CA'	F8 67	SEQCYC: LDI SEQRAT ;SPECIAL SEQUENCER RATE NEEDED? (SEQRAT .NE. 00 ?)
2021	09CC'	A7	PLO GPAGE
2022	09CD'	07	LDN GPAGE
2023	09CE'	32 EE'	BZ SEQ01 ; IF NOT RUN ONLY ON CYCLE #1
2024		;	

MACRO-18 3.36 PAGE 1-44
SEA DUCT: SD05R9.MAC 16 SEP 86

2025 09D0' FA 80 ANI 80H ;SEQRAT MSB = 1? (1XXX XXXX)
2026 09D2' C2 0A22' LBZ CYXXNN ; IF NOT, WAIT FOR CYCLE #NN OR #01 (GO TO CYXXNN)
2027 ;
2028 09D5' 07 LDW GPAGE ;IF MSB = 1 (8X), CHECK LOW NIBBLE
2029 09D6' FB 80 XRI 80H ; (1000 0000) = EVERY CYCLE
2030 09D8' C2 0B00' LBZ SEQNCR ; (1000 0001) = EVERY OTHER CYCLE
2031 09DB' FB 01 XRI 01 ; (1000 0010) = EVERY FOURTH CYCLE
2032 09DD' 32 FA' BZ CYXXX1 ; (1000 0100) = EVERY EIGHT CYCLE
2033 09DF' FB 03 XRI 03 ;
2034 09E1' C2 0A06' LBZ CYXX01 ; (1000 1111) = EVERY FOURTH CYCLE
2035 09E4' FB 06 XRI 06 ; (PINGER CONTROL ONLY)
2036 09E6' C2 0A14' LBZ CYX001 ;
2037 09E9' FB 08 XRI 08H ;IF NONE OF THE ABOVE,
2038 09EB' C2 0A06' LBZ CYXX01 ; RUN ONLY ON CYCLE #01
2039 ;
2040 09EE' F8 19 SEQ01: LDI CYCLES ;CHECK CYCLE #
2041 09F0' A7 PLO GPAGE
2042 09F1' 07 LDW GPAGE
2043 09F2' FB 01 XRI 01 ;RUN SEQUENCER ONLY ON CYCLE 01
2044 09F4' C2 0B00' LBZ SEQNCR
2045 09F7' C0 086D' LBR SEQRTN
2046 ;
2047 09FA' F8 19 CYXXX1: LDI CYCLES ;RUN EVERY OTHER CYCLE
2048 09FC' A7 PLO GPAGE
2049 09FD' 07 LDW GPAGE
2050 09FE' FA 01 ANI 01
2051 0A00' CA 0B00' LBNZ SEQNCR
2052 0A03' C0 086D' LBR SEQRTN
2053 ;
2054 0A06' F8 19 CYXX01: LDI CYCLES ;RUN EVERY FOURTH CYCLE
2055 0A08' A7 PLO GPAGE
2056 0A09' 07 LDW GPAGE
2057 0A0A' FA 03 ANI 03
2058 0A0C' FB 01 XRI 01
2059 0A0E' C2 0B00' LBZ SEQNCR
2060 0A11' C0 086D' LBR SEQRTN
2061 ;
2062 0A14' F8 19 CYX001: LDI CYCLES ;RUN EVERY EIGHT CYCLE
2063 0A16' A7 PLO GPAGE
2064 0A17' 07 LDW GPAGE
2065 0A18' FA 07 ANI 07
2066 0A1A' FB 01 XRI 01
2067 0A1C' C2 0B00' LBZ SEQNCR
2068 0A1F' C0 086D' LBR SEQRTN
2069 ;
2070 0A22' 07 CYXXNN: LDW GPAGE ;RUN ON ONLY CYCLES = NN OR 01

MACRO-18 3.36 PAGE 1-45
SEA DUCT: SD05R9.MAC 16 SEP 86

2071 0A23' FA 7F ANI 7FH
2072 0A25' AD PLO RD
2073 0A26' F8 19 LDI CYCLES
2074 0A28' A7 PLO GPAGE
2075 0A29' E7 SEX GPAGE
2076 0A2A' 8D GLO RD
2077 0A2B' F3 XOR
2078 0A2C' C2 0B00' LBZ SEQNCR ;ON CYCLES = NN, RUN SEQUENCER
2079 0A2F' C0 09F1' LBR (SEQ01 + 3) ;CHECK FOR CYCLES = 01
2080 ;
2081 ;
2082 ;***** TTY2 *****
2083 ;
2084 0A32' F8 7E TTY3: LDI TTY2HI ;CHECK LOOP 2 OUTPUT LIST PTR
2085 0A34' A7 PLO GPAGE
2086 0A35' 07 LDW GPAGE
2087 0A36' C2 0870' LBZ TY2RTN ;IF CLEAR (=00), RETURN TO LBT
2088 0A39' E7 SEX GPAGE
2089 ;RLXA RTTY2 ;LOAD TTY2 POINTER (REG RTTY2)
2090 0A3A' 68 6F
2091 0A3C' 27 DEC GPAGE
2092 0A3D' 0F LDW RTTY2 ;GET N(RTTY2)
2093 0A3E' F9 FF XRI 0FFH ;IS IT FF ?
2094 0A40' C2 0870' LBZ TY2RTN ; : IF SO RETURN TO LBT
2095 0A43' F9 6F XRI (0FFH XOR 090H) ;IS IT 90 ?
2096 0A45' 02 5C' BZ TY2ETX ; : IF SO GO TO TTY2-ETX
2097 ;
2098 0A47' E1 TY2OUT: SEX INTPC ;TYPE ON LOOP2
2099 0A48' 61 OUT GROUP
2100 0A49' 06 DB UARTS ; SET UART GROUP
2101 0A4A' E2 SEX STACK
2102 0A4B' 6D INP STAT2 ; CHECK STATUS
2103 0A4C' FB C0 XRI 0COH ; INVERT
2104 0A4E' FA C0 ANI 0COH ; MASK FOR THERE AND TSRE
2105 0A50' CA 0870' LBNZ TY2RTN
2106 0A53' 6C INP DATA2 ; CLEAR ECHO DA
2107 0A54' E7 SEX RTTY2
2108 0A55' 64 OUT DATA2 ; SEND DATA ON LOOP 2
2109 0A56' E7 SEX GPAGE
2110 ;RSXD RTTY2 ;SET DATA POINTER ON GLOBAL PAGE
2111 0A57' 68 AF
2112 0A59' C0 0870' LBR TY2RTN
2113 ;
2114 0A5C' E1 TY2ETX: SEX INTPC ;WAIT FOR ETX
2115 0A5D' 61 OUT GROUP ; SET UART GROUP
2116 0A5E' 06 DB UARTS

MACRO-18 3.36 PAGE 1-46
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

2117 0A5F' E2           SEX STACK
2118 0A60' 6D           INP STAT2      ; CHECK STATUS
2119 0A61' FB C0        XRI 0COH      ; INVERT
2120 0A63' FA C0        ANI 0COH      ; MASK FOR THRE AND TSRE
2121 0A65' CA 0870'     LBNZ TY2RTN   ; RETURN TO LBT IF REGS. NOT EMPTY
2122 0A68' E2           SEX STACK
2123 0A69' 6D           INP STAT2      ; DA?
2124 0A6A' F6           SHR
2125 0A6B' C8 0870'     LBNF TY2RTN   ; IF NOT RETURN TO LBT
2126 0A6C' 6C           INP DATA2      ; IF DA2
2127 0A6F' FA 7F        ANI 07FH      ; MASK MSB
2128 0A71' FB 03        XRI 03        ; IS IT ETX ?
2129 0A73' CA 0870'     LBNZ TY2RTN   ; IF NOT ETX, RETURN TO LBT
2130 0A76' 1F           INC RTTY2      ; IF ETX, INC. RTTY2 LIST POINTER
2131 0A77' E7           SEX GPAGE
2132                         RSXD RTTY2      ; AND RESTORE
2133 0A78' 68 AF        +             ; LBR TY2RTN      ; RTN TO LBT
2134 0A7A' C0 0870'     ; :
2135 ; :
2136 ; :
2137 ; ***** BREAK LOOP 3 ? *****
2138 ; :
2139 ; :
2140 0A7D' F8 7D        BR2: LDI BR2CNT    ; GET BREAK COUNT FROM GPAGE
2141 0A7F' A7           PLO GPAGE
2142 0A80' 07           LDN GPAGE
2143 0A81' FB C0        XRI 00
2144 0A83' C8 0873'     LBZ BR2RTN    ; IF 0, RETURN TO LBT
2145 0A86' 07           LDN GPAGE    ; IF NOT, DECREMENT COUNT
2146 0A87' FF 01        SMI 01
2147 0A89' 57           STR GPAGE
2148 0A8A' CA 0873'     LBNZ BR2RTN   ; IF NOT 0, RETURN TO LBT
2149 0A8D' E1           BR2CLR: SEX INTPC  ; IF NOW 0, RESET UART 2
2150 0A8E' 61           OUT GROUP
2151 0A8F' 06           DB UARTS
2152 0A90' 65           OUT CNTRL2
2153 0A91' 12           DB FORMT1
2154 0A92' 64           OUT DATA2    ; SEND NULL TO RESET UART 2
2155 0A93' 00           DB 00
2156 0A94' C0 0873'     LBR BR2RTN   ; RETUTN TO LBT
2157 ; :
2158 ; :
2159 ; :
2160 ; ***** TIME OUT COUNTER FUNCTIONS *****
2161 ; *** RUNS ON CYCLES = 26H ONLY ***
2162 ;
  
```

MACRO-18 3.36 PAGE 1-47
 SEA DUCT: SD05R9.MAC 16 SEP 36

2163	0A97'	F8 19	CTRCHK: LDI CYCLES	;RUN ONLY ON CYCLE 26H (NEXT TO LAST CYCLE)
2164	0A99'	A7	PLO GPAGE	
2165	0A9A'	07	LDN GPAGE	
2166	0A9B'	F8 26	XRI 26H	
2167	0A9D'	CA 0876'	LBNZ CTRRTN	;RETURN TO LBT IF CYCLE NOT = 26H
2168			;	
2169	0AA0'	E2	CTCHK: SEX STACK	
2170			SCAL R6, CTNCHK	
2171	0AA1'	68 36	+	
2172	0AA3'	0AB6'	+	
2173	0AA5'	6C	DB CTAHI	
2174	0AA6'	6E	DB CTAVHI	
2175			;	
2176			SCAL R6, CTNCHK	
2177	0AA7'	68 36	+	
2178	0AA9'	0AB6'	+	
2179	0AAB'	70	DB CTBHI	
2180	0AAC'	72	DB CTBVHI	
2181			;	
2182			SCAL R6, CTNCHK	
2183	0AAD'	68 36	+	
2184	0AAF'	0AB6'	+	
2185	0ABI'	74	DB CTCHI	
2186	0AB2'	76	DB CTCVHI	
2187			;	
2188	0AB3'	CA 0876'	LBR CTRRTN	;RETURN TO LBT
2189			;	
2190			;	
2191	0AB6'	46	CTNCHK: LDA LIST	
2192	0AB7'	A7	PLO GPAGE	;EXIT IF CNTR A = 0
2193	0AB8'	E7	SEX GPAGE	
2194			RLXA RA	;PUT CNT(n) IN RA
2195	0AB9'	68 6A	+	
2196	0ABB'	9A	GHI RA	; Is it =0 ?
2197	0ABC'	JA C1'	BNZ CTNDEC	
2198	0ABE'	8A	GLO RA	
2199	0ABF'	32 E1'	BZ (CTNRTN-1)	;SKIP VECTOR POINTER IN PASSLIST AND RETURN
2200			;	
2201	0AC1'	2A	CTNDEC: DEC RA	;DECREMENT CNTR N AND
2202	0AC2'	9A	GHI RA	;BRANCH TO CTNSTR IF NOT =0
2203	0AC3'	JA DE'	BNZ CTNSTR	
2204	0AC5'	8A	GLO RA	
2205	0AC6'	JA DE'	BNZ CTNSTR	;IF CNTR N = 0, STORE 0 COUNT
2206	0AC8'	27	DEC GPAGE	
2207			RSXD RA	
2208	0AC9'	68 AA	+	

MACRO-18 3.36 PAGE 1-48
SEA DUCT: SD05R9.MAC 16 SEP 86

2209 OACB' 46 LDA LIST ;GET CT(n)VHI FROM PASSLIST
2210 OACC' A7 PLO GPAGE ; and put it in RA
2211 RIXA RA
2212 OACD' 68 6A +
2213 OACF' F8 61 LOI PPCLO ;Put the new PPC in the
2214 OADI' A7 PLO GPAGE ; PPC pointer
2215 OAD2' E7 SEX GPAGE
2216 RSXD RA
2217 OAD3' 68 AA +
2218 OADS' F8 68 LDI PPCCNT ;SET =00:
2219 OAD7' A7 PLO GPAGE
2220 OAD8' F8 00 LDI 00 ; PPCCNT
2221 OADA' 73 STXD ; SEQRAT
2222 OADB' 73 STXD
2223 OADC' 30 E2' BR CTNRTN ;GO TO CNTRTN
2224 ;
2225 OADE' 27 CTNSTR: DEC GPAGE ;STORE COUNTER N
2226 RSXD RA
2227 OADF' 68 AA +
2228 OAE1' 16 INC LIST ;SKIP VECTOR POINTER IN PASSLIST
2229 ;
2230 OAE2' E2 CTNRTN: SEX STACK ;RETURN
2231 SRET R6
2232 OAE3' 68 96 +
2233 ;
2234 ;
2235 ;
2236 ;***** SEQUENCER *****
2237 ;
2238 ORG (INTPGM + 300H)
2239 ;
2240 ;*** LOCATION OF VARIOUS ELEMENTS IN THIS SECTION ARE ***
2241 ;*** EXTREMELY CRITICAL ! MUST START AT A PAGE START ***
2242 ;
2243 ;
2244 OB00' F8 60 SEQNCR: LDI PPCHI
2245 OB02' A7 PLO GPAGE
2246 OB03' 47 LDA GPAGE
2247 OB04' 3C PHI PPC ;SET UP PPC
2248 OB05' 47 LDA GPAGE
2249 OB06' AC PLO PPC
2250 OB07' 47 LDA GPAGE
2251 OB08' BD PHI RSTK ;SET UP R STACK
2252 OB09' 47 LDA GPAGE
2253 OB0A' AD PLO RSTK
2254 OB0B' 47 LDA GPAGE

MACRO-18 3.36 PAGE 1-49
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

2255 0B0C' BE      PHI ASTK      ;SET UP A STACK
2256 0B0D' 47     LDA GPAGE
2257 0B0E' AE      PLO ASTK
2258 0B0F' 0C      LDN PPC       ;GET NEXT PPC
2259 0B10' FA FC   ANI OFCH     ;MASK TO DECODE PPC
2260 0B12' A1      PLO INTPC   ;REDIRECT INTERRUPT PC TO PPC
2261
2262
2263 0B13' 1C      INCPPC::INC PPC ;SET UP FOR NEXT PPC
2264 0B14' C0 0C00' SAVE:: LBR SAVPPC
2265
2266 0B17' 2C      DECPPC::DEC PPC ;SET UP FOR PREVIOUS PPC
2267 0B18' 30 14'   BR SAVE     ; USED BY EXT. SEQUENCER FUNCTIONS
2268
2269
2270
2271 ;***** PPC's START HERE *****
2272
2273
2274          ORG (SEQNCR + 28H)
2275 0B28' 1C      JUMP:: INC PPC   ;JUMP TO PPC AT AAAA
2276 0B29' 30 66'   BR JMPEXC
2277
2278
2279          ORG (SEQNCR + 30H)
2280 0B30' 4C      PUSH:  LDA PPC    ;PUSH N BYTES TO A STACK
2281 0B31' FA 03   ANI 03
2282 0B33' A9      PLO R9
2283 0B34' 2E      PUSH1: DEC ASTK
2284 0B35' 4C      LDA PPC    ;LOAD IMMEDIATE PPC BYTE
2285 0B36' 5E      STR ASTK
2286 0B37' 89      GLO R9
2287 0B38' 32 14'  BZ SAVE    ;ANOTHER BYTE ?
2288 0B3A' 29      DEC R9
2289 0B3B' 30 34'  BR PUSH1
2290
2291
2292          ORG (SEQNCR + 40H)
2293 0B40' 4C      POP:   LDA PPC    ;POP N BYTES FROM A STACK
2294 0B41' FA 03   ANI 03
2295 0B43' A9      PLO R9
2296 0B44' 1E      POP1:  INC ASTK
2297 0B45' 89      GLO R9
2298 0B46' 32 14'  BZ SAVE
2299 0B48' 29      DEC R9
2300 0B49' 30 44'  BR POP1
  
```

MACRO-18 3.36
SEA DUCT: SD05R9.MAC 16 SEP 86

2301 ;
2302 ;
2303 ORG (SEQNCR + 4CH)
2304 0B4C' C0 0C22' INIT: LBR INITX
2305 ;
2306 ;
2307 ORG (SEQNCR + 58H)
2308 0B58' 1D RETURN: INC RSTK
2309 0B59' 4D LDA RSTK ;RETURN FROM PCC SUBROUTINE
2310 0B5A' BC PHI PPC
2311 0B5B' 0D LDN RSTK
2312 0B5C' AC PLO PPC
2313 0B5D' 1C INC PPC
2314 0B5E' 30 13' BR INCPPC
2315 ;
2316 ;
2317 ORG (SEQNCR + 60H)
2318 0B60' 1C GOSUB: INC PPC ;GOTO PPC SUBROUTINE
2319 0B61' ED SEX RSTK
2320 0B62' 8C GLO PPC
2321 0B63' 73 STXD
2322 0B64' 9C GHI PPC
2323 0B65' 73 STXD
2324 0B66' 4C JMPEXC: LDA PPC
2325 0B67' A9 PLO R9
2326 0B68' 0C LDN PPC
2327 0B69' AC PLO PPC
2328 0B6A' 89 GLO R9
2329 0B6B' BC PHI PPC
2330 0B6C' 30 14' BR SAVE
2331 ;
2332 ;
2333 ORG (SEQNCR + 70H)
2334 0B70' 0C WTILL: LDN PPC ;WAIT TILL DAYS, HOURS,
2335 0B71' FA 03 ANI 03 ;MIN, SEC ON RTC
2336 0B73' FE SHL
2337 0B74' FC 11 ADI D10
2338 0B76' A7 PLO GPAGE
2339 0B77' E2 SEX STACK
2340 SCAL R6, CMPARE
2341 0B78' 68 86 +
2342 0B7A' 0C9C' +
2343 0B7C' 33 13' BDF INCPPC
2344 0B7E' 30 14' BR SAVE
2345 ;
2346 ;

MACRO-18 3.36 PAGE 1-51
SEA DUCT: SD05R9.MAC 16 SEP 86

2347 ORG (SEQNCR + 80H)
2348 0B80' C0 0C6F' WTFOR: LBR WTFORK
2349 ;
2350 ;
2351 ORG (SEQNCR + 0A0H)
2352 0BA0' C0 0D3A' CTA: LBR CTAX
2353 ;
2354 ;
2355 ORG (SEQNCR + 0B0H)
2356 0BB0' C0 0D57' CTB: LBR CTBX
2357 ;
2358 ;
2359 ORG (SEQNCR + 0C0H)
2360 0BC0' C0 0D74' CTC: LBR-CTCX
2361 ;
2362 ;
2363 ORG (SEQNCR + 0C4H)
2364 0BC4' 30 13' NOOP: BR INCPPC ;PPC NO OP
2365 ;
2366 ;
2367 ORG (SEQNCR + 0C8H)
2368 ;*** ADDITIONAL PSEUDO CODES CAN BE INSERTED HERE ***
2369 ;
2370 ;
2371 ORG (SEQNCR + 0D0H)
2372 0BD0' C0 0CB9' LOOP2: LBR LOOP2X ;START OUTPUT LIST ON LOOP 2
2373 ; ; AND PWR ON/OFF LOOP 2
2374 ;
2375 ;
2376 ORG (SEQNCR + 0E0H)
2377 0BE0' C0 1800' SEQXTL: LBR HELP + 800H ;SEA DUCT EXTENDED SEQUENCER
2378 ; ; FUNCTION PREFIX
2379 ;
2380 ;*** MORE PSEUDO CODES CAN BE INSERTED HERE ***
2381 ;
2382 ;
2383 ;
2384 ORG (SEQNCR + 100H)
2385 ;
2386 ;***** BASIC SEQUENCER IN THIS SECTION ARE CALLED BY THE
2387 ; PREVIOUS PROGRAM PAGE *****
2388 ;
2389 ;
2390 0C00' F8 65 SAVPPC::LDI ASTKLO ;SAVE PPC AND STACKS ON GPAGE
2391 0C02' A7 PLO GPAGE
2392 0C03' B7 SEX GPAGE

MACRO-18 3.36 PAGE 1-52
SEA DUCT: SD05R9.MAC 16 SEP 86

2393 0C04' 8E GLO ASTK
2394 0C05' 73 STXD
2395 0C06' 9E GHI ASTK
2396 0C07' 73 STXD
2397 0C08' 8D GLO RSTK
2398 0C09' 73 STXD
2399 0C0A' 9D GHI RSTK
2400 0C0B' 73 STXD
2401 0C0C' 8C GLO PPC
2402 0C0D' 73 STXD
2403 0C0E' 9C GHI PPC
2404 0C0F' 57 STR GPAGE ;GPAGE -> PPCHI
2405 ;
2406 ;
2407 0C10' E1 FLAGCK: SEX INTPC ;THIS SECTION COULD CHECK INSTRUMENT
2408 ;*** DO FLAG CHECKS ; SPECIFIC FLAGS (ON / OFF)
2409 ; AS NECESSARY ; AND PERFORM THE INDICATED
2410 ; THEN ... *** ; OPERATION WHEN SEQUENCER
2411 ; ; EXITS TO LBT
2412 ;
2413 0C11' C0 086D' LBR SEQRTN ;RETURN TO LBT
2414 ;
2415 ;
2416 ;
2417 ;
2418 ;
2419 0C14' A7 SETCLR::PLO GPAGE ;SET OR CLR FLAG ON GPAGE
2420 0C15' 4C LDA PPC
2421 0C16' F6 SHR
2422 0C17' 33 1C' BDF SETAC
2423 0C19' F8 00 LDI 00
2424 0C1B' C8 LSKP
2425 0C1C' F8 AC SETAC: LDI 0ACH
2426 0C1E' 57 STR GPAGE
2427 0C1F' C0 0B14' LBR SAVE
2428 ;
2429 ;
2430 ;***** INITIALIZE STACKS AND COUNTERS - 4C, 4D, 4E *****
2431 ;
2432 0C22' 0C INITX: LDN PPC
2433 0C23' FA 03 ANI 03
2434 0C25' 32 37' BZ INITS ;4C = INITIALIZE ONLY SEQ. STACKS, PPCCNT,
2435 0C27' FB 01 XRI 01 ; FASTMODE, ETC.
2436 0C29' 32 32' BZ INITB ;4D = INITIALIZE BOTH
2437 0C2B' FB 03 XRI (01 XOR 02)
2438 0C2D' 32 3F' BZ INITC ;4E = INITIALIZE ONLY SEQ. COUNTERS

MACRO-18 3.36 PAGE 1-53
SEA DUCT: SD05R9.MAC 16 SEP 86

2439 OC2F' C0 0B13' LBR INCPPC
2440 ;
2441 OC32' E2 INITB: SEX STACK
2442 ; SCAL R6, CNTCLR
2443 OC33' 68 86 +
2444 OC35' OC47' +
2445 ;
2446 OC37' E2 INITB: SEX STACK
2447 ; SCAL R6, STKCLR
2448 OC38' 68 86 +
2449 OC3A' OC59' +
2450 OC3C' C0 0B13' LBR INCPPC
2451 ;
2452 OC3F' E2 INITC: SEX STACK
2453 ; SCAL R6, CNTCLR
2454 OC40' 68 86 +
2455 OC42' OC47' +
2456 OC44' C0 0B13' LBR INCPPC
2457 ;
2458 ;*** SUBROUTINES FOR INITIALIZE ***
2459 ;
2460 ;
2461 OC47' E2 CNTCLR: SEX STACK :CLEAR COUNTERS A, B, C
2462 ; SCAL R6, CTNCLR
2463 OC48' 68 86 +
2464 OC4A' ODA3' +
2465 OC4C' 6D DB CTALO
2466 ; SCAL R6, CTNCLR
2467 OC4D' 68 86 +
2468 OC4F' ODA3' +
2469 OC51' 71 DB CTBLO
2470 ; SCAL R6, CTNCLR
2471 OC52' 68 86 +
2472 OC54' ODA3' +
2473 OC56' 75 DB CTCLO
2474 ; SRET R6 :RETURN
2475 OC57' 68 96 +
2476 ;
2477 ;
2478 OC59' F8 52 STKCLR: LDI SSTKPG :INITIALISE STACKS
2479 OC5B' BD PRI RSTK
2480 OC5C' BB PRI ASTK
2481 OC5D' F8 3F LDI LOW(RSTKTP)
2482 OC5F' AD PLO RSTK ; R STACK
2483 OC60' F8 7F LDI LOW(ASTKTP)
2484 OC62' AB PLO ASTK ; A STACK

MACRO-18 3.36 PAGE 1-54
SEA DUCT: SD0539.MAC 16 SEP 86

2485	0C63'	F8 68	LDI PPCCNT
2486	0C65'	A7	PLO GPAGE
2487	0C66'	B7	SEX GPAGE
2488	0C67'	F8 00	LDI 00
2489	0C69'	73	STXD ;CLEAR PPC COUNT
2490	0C6A'	73	STXD ;SET SEQUENCER RATE TO CYCLZ 1 ONLY
2491	0C6B'	73	STXD ;CLEAR FAST SEQUENCER MODE
2492	0C6C'	S2	SEX STACK
2493			SRET R6 ;RETURN
2494	0C6D'	68 96	+
2495			;
2496			;
2497			***** 'Wait For' Sequencer Code *****
2498			;
2499	0C6F'	0C	WTFORX: LDN PPC ;WAIT FOR DAYS, HOURS, MIN
2500	0C70'	F4 03	ANI 03 ;GET LOW NIBBLE
2501	0C72'	FE	SHL
2502	0C73'	FC 13	ADI H10
2503	0C75'	A7	PLO GPAGE
2504	0C76'	C4	NOP
2505	0C77'	2E	PUSH00: DEC ASTK
2506	0C78'	F8 00	LDI 00
2507	0C7A'	5E	STR ASTK
2508	0C7B'	S2	SEX STACK
2509			SCAL R6, CMPARE
2510	0C7C'	68 86	+
2511	0C7E'	0C9C'	+
2512	0C80'	33 88'	BDF MATCH3
2513	0C82'	1E	INC ASTK
2514	0C83'	C0 0B14'	LBR SAVE
2515	0C86'	C4	NOP
2516	0C87'	C4	NOP
2517			;
2518	0C88'	87	MATCH3: GLO GPAGE
2519	0C89'	F3 19	XRI CYCLES
2520	0C8B'	3A 77'	BNZ PUSH00
2521	0C8D'	C4	NOP
2522	0C8E'	C4	NOP
2523	0C8F'	0E	LDN ASTK
2524	0C90'	32 98'	BZ STKERR
2525	0C92'	FF 01	SMI 01 ;DEC. COUNT
2526	0C94'	5E	STR ASTK
2527	0C95'	CA 0B14'	LBNZ SAVE
2528	0C98'	1E	STKERR: INC ASTK
2529	0C99'	C0 0B13'	LBR INCPPC
2530			;

MACRO-18 3.36 PAGE 1-55
SEA DUCT: SD05R9.MAC 16 SEP 86

2531 ;
2532 ;***** COMPARE TIME SUBROUTINE *****
2533 ;***** Used by Wait Till and Wait For *****
2534 ;
2535 0C9C' 47 CMPARE: LDA GPAGE ;GET X 10 DIGIT
2536 0C9D' F3 SHL
2537 0C9E' FE SHL
2538 0C9F' FE SHL
2539 0CA0' FE SHL
2540 0CA1' EE SEX ASTK
2541 0CA2' F3 XOR
2542 0CA3' FA F0 ANI OFH ;CONSIDER HI DIGIT
2543 0CA5' 32 AD BZ CHR1
2544 0CA7' FC 00 NOMBCH: ADI 00 ;CLEAR DF
2545 0CA9' 27 DEC GPAGE
2546 0CAA' E2 SEX STACK
2547 SRET R6
2548 0CAB' 68 96 +
2549 0CAD' 47 CHX1: LDA GPAGE
2550 0CAE' F3 XOR
2551 0CAF' FA 0F ANI OFH ;CONSIDER LO DIGIT
2552 0CB1' 3A A7 BNZ NOMBCH
2553 0CB3' FF 00 SMI 00 ;SET DF
2554 0CB5' 1E INC ASTK
2555 0CB6' E2 SEX STACK
2556 SRET R6
2557 0C87' 68 96 +
2558 ;
2559 ;
2560 ;*** LOOP 2 -- PWR ON; OFF; ON AND SEND DATA ON LOOP 2 *****
2561 ;***** D0= PWR OFF, D1= PWR ON, D2nnnn = PWR ON AND SEND DATA LOOP 2 *****
2562 ;
2563 ;
2564 0CB9' 0C LOOP2X: LDN PPC ;IS PPC D0, D1, OR D2?
2565 0C8A' FA 03 ANI 03 ; MASK FOR 2 LSB'S
2566 0C8C' 32 C9 BZ LP2OFF ; IF D0, LOOP 2 PWR OFF
2567 0C8E' FB 01 XRI 01
2568 0CC0' 32 D1 BZ LP2ON ; IF D1, LOOP 2 PWR ON
2569 0CC2' FB 03 XRI 01 XOR 02
2570 0CC4' 32 D9 BZ LP2XMT ; IF D2, LOOP 2 PWR ON AND SEND DATA
2571 0CC6' C0 0D2D' LBR LP2XIT ;IF NOT 1, 2, OR 3, GO TO NEXT PPC
2572 ;
2573 0CC9' E1 LP2OFF: SEX INTPC ;D0 = LOOP2 PWR OFF
2574 0CCA' 61 OUT GROUP
2575 0CCB' 02 DB 02
2576 0CCC' 67 OUT RELAYS

MACRO-18 J.36 PAGE 1-56
SEA DUCT: SD05R9.MAC 16 SEP 86

2577 OCCD' 00 DB 00
2578 OCCE' C0 0B13' LBR INCPPC
2579 ;
2580 OCD1' E1 LP2ON: SEX INTPC ;D1 = LOOP 2 PWR ON
2581 OCD2' 61 OUT GROUP
2582 OCD3' 02 DB 02
2583 OCD4' 67 OUT RELAYS
2584 OCD5' 40 DB 100Q
2585 OCD6' C0 0B13' LBR INCPPC
2586 ;
2587 OCD8' F8 68 LP2XMT: LDI PPCNT ;D2 = LOOP2 PWR ON, SEND LIST ON LOOP2 VIA TTY2
2588 OCD9' A7 PLO GPAGE ; CHECK IF 1st TIME THRU THIS PPC
2589 OCD1' 07 LDW GPAGE ; *** NOTE: 60 SEC. TIMEOUT
2590 OCD2' 32 FF' BZ LP2OTH ; ON THIS PART OF PPC! ***
2591 OCD3' FB 01 XRI 01
2592 OCD4' C2 0D11' LBZ LP21ST
2593 ;
2594 OCD5' F8 7E LP2NTH: LDI TTY2HI ;NEXT TIME THRU:
2595 OCD6' A7 PLO GPAGE ; LOOK AT TTY2 CHARACTER
2596 OCD7' B7 SEX GPAGE
2597 ; RLXA R9 ;LOAD TTY2 POINTER INTO R9
2598 OCD8' 68 69 +
2599 OCD9' 09 LDW R9 ;LOOK AT TTY2 DATA
2600 OCD1' FB FF XRI OFFH ; IS IT FF?
2601 OCD2' C6 LSNZ ; IF SO, GO TO LP2XIT
2602 OCD3' C0 0D2D' LBR LP2XIT ; IF NOT, CONTINUE
2603 OCD4' EE SEX ASTK
2604 OCD5' 08 LDW ASTK
2605 OCD6' F8 3C XRI 03CH ; 60 SEC. UP?
2606 OCD7' C2 0D26' LBZ LP2ERR ; IF SO, GO TO LP2ERR ROUTINE
2607 OCD8' F8 01 LDI 01 ; IF NOT, CONTINUE THIS PPC
2608 OCD9' F4 ADD ;ADD 01 TO ASTK
2609 OCD1' 5E STR ASTK
2610 OCD2' C0 0C00' LBR SAVPPC
2611 ;
2612 ;
2613 OCD3' F8 01 LP2OTH: LDI 01 ;FIRST TIME THRU:
2614 OCD4' 57 STR GPAGE ; SET PPC COUNT = 01
2615 ;
2616 OCD5' E1 SEX INTPC ;SELECT I/O GROUP 02
2617 OCD6' 61 OUT GROUP
2618 OCD7' 02 DB 02
2619 OCD8' 67 OUT RELAYS ;LOOP 2 PWR ON
2620 OCD9' 40 DB 100Q
2621 OCD1' ;
2622 OCD2' F8 80 LDI ERROR ;CLEAR LOOP 2 ERROR BITS (0,1) IF PRESENT

MACRO-18 3.36 PAGE 1-57
SEA DUCT: SD05R9.MAC 16 SEP 86

2623 0D09' A7 PLO GPAGE
2624 0D0A' 07 LDN GPAGE
2625 0D0B' FA FC ANI OFCH
2626 0D0D' 57 STR GPAGE
2627 0D0E' C0 0C00' LBR SAVPPC
2628 ;
2629 ;
2630 0D11' F8 02 LP21ST: LDI 02 :2nd TIME THRU:
2631 0D13' 57 STR GPAGE : SET PPC COUNT = 02
2632 ;
2633 0D14' 1C INC PPC :SEND DATA ON LOOP 2
2634 0D15' F8 78 LDI TTY2HI : UNDER SEQUENCER CONTROL
2635 0D17' A7 PLO GPAGE : BY PUTTING SEND-LIST POINTER
2636 0D18' 4C LDA PPC : IN TTYHI AND TTYLO FOR TTY2
2637 0D19' 57 STR GPAGE
2638 0D1A' 17 INC GPAGE
2639 0D1B' 0C LDN PPC
2640 0D1C' 57 STR GPAGE
2641 0D1D' 2B DEC ASTK
2642 0D1E' F8 00 LDI 00 :SET ASTK TO 00 TO START
2643 0D20' 52 STR ASTK : TIME OUT LOOP
2644 0D21' 2C DEC PPC :DECREMENT PPC TWICE TO RUN
2645 0D22' 2C DEC PPC : AGAIN ON NEXT PASS
2646 0D23' C0 0C00' LBR SAVPPC
2647 ;
2648 ;
2649 0D26' F8 80 LP2ERR: LDI ERROR :SET LOOP 2 ERROR BIT (01)
2650 0D28' A7 PLO GPAGE :ERROR SET BY TIME OUT
2651 0D29' 07 LDN GPAGE
2652 0D2A' F9 02 ORI 02
2653 0D2C' 57 STR GPAGE
2654 ;
2655 ;
2656 0D2D' 1C LP2XIT: INC PPC :MOVE TO NEXT PPC
2657 0D2E' 1C INC PPC
2658 0D2F' 1C INC PPC
2659 0D30' 18 INC ASTK
2660 0D31' F8 68 LDI PPPCNT :CLEAR PPC COUNT
2661 0D33' A7 PLO GPAGE
2662 0D34' F8 00 LDI 00
2663 0D36' 57 STR GPAGE
2664 0D37' C0 0C00' LBR SAVPPC
2665 ;
2666 ;
2667 ;
2668 ;***** SEQUENCER COUNTER A CONTROL *****

MACRO-18 3.36 PAGE 1-58
SEA DUCT: SD05R9.MAC 16 SEP 86

2669
2670 0D3A' 0C ;
2671 0D3B' FA 03 CTAX: LDN PPC ;SET OR CLEAR CNTR A
2672 0D3D' 32 45' ANI 03 ; A0 = CLEAR
2673 0D3F' F6 BZ CTACLR ; A1 = SET (B1 CCCC AAAA)
2674 0D40' 33 4E' SHR ; A2 = A3 = IGNORED
2675 0D42' C0 0B13' BDF CTASET ; WHERE CCCC = COUNT IN SECONDS
LBR INCPPC ; AND AAAA = VECTOR ADDR AT CNT = 0000
2676 ;
2677 0D45' E2 CTACLR: SEX STACK
2678 SCAL R6, CTNCLR ;CLEAR COUNTER A
2679 0D46' 68 86 +
2680 0D48' 0DA3' +
2681 0D4A' 60 DB CTALO
2682 0D4B' C0 0B13' LBR INCPPC
2683 ;
2684 0D4E' E2 CTASET: SEX STACK ;SET COUNTER B
2685 SCAL R6, CTNSET
2686 0D4F' 68 86 +
2687 0D51' 0D91' +
2688 0D53' 6C DB CTABI
2689 0D54' C0 0C00' LBR SAVPPC ;GO TO SAVE PPC
2690 ;
2691 ;
2692 ;***** SEQUENCER COUNTER B CONTROL *****
2693 ;
2694 0D57' 0C CTBX: LDN PPC ;SET OR CLEAR CNTR B
2695 0D58' FA 03 ANI 03 ; B0 = CLEAR
2696 0D5A' 32 62' BZ CTBCLR ; B1 = SET (B1 CCCC AAAA)
2697 0D5C' F6 SHR ; B2 = B3 = IGNORED
2698 0D5D' 33 6B' BDF CTBSET ; WHERE CCCC = COUNT IN SECONDS
2699 0D5F' C0 0B13' LBR INCPPC ; AND AAAA = VECTOR ADDR AT CNT = 0000
2700 ;
2701 0D62' E2 CTBCLR: SEX STACK
2702 SCAL R6, CTNCLR ;CLEAR COUNTER B
2703 0D63' 68 86 +
2704 0D65' 0DA3' +
2705 0D67' 71 DB CTBLO
2706 0D68' C0 0B13' LBR INCPPC
2707 ;
2708 0D6B' E2 CTBSET: SEX STACK ;SET COUNTER B
2709 SCAL R6, CTNSET
2710 0D6C' 68 86 +
2711 0D6E' 0D91' +
2712 0D70' 70 DB CTBHI
2713 0D71' C0 0C00' LBR SAVPPC ;GO TO SAVE PPC
2714 ;

SEA DUCT: SD05R9.MAC 16 SEP 86

```

2715 ;***** SEQUENCER COUNTER C CONTROL *****
2716 ;
2717 ;
2718 0D74' 0C      CTCX: LDW PPC      :SET OR CLEAR CNTR C
2719 0D75' FA 03    ANI 03       ; C0 = CLEAR
2720 0D77' 32 7F'   BZ CTCCLR    ; C1 = SET (C1 CCCC AAAA)
2721 0D79' F6       SHR          ; C2 = C3 = IGNORED
2722 0D7A' 33 88'   BDF CTCSET   ; WHERE CCCC = COUNT IN SECONDS
2723 0D7C' CO 0B13'  LBR INCPPC  ; AND AAAA = VECTOR ADDR AT CNT = 0000
2724 ;
2725 0D7E' E2      CTCCLR: SEX STACK
2726 ;           SCAL R6, CTNCLR ;CLEAR COUNTER C
2727 0D80' 68 96    +
2728 0D82' 0DAJ'    +
2729 0D84' 75       DB CTCLO
2730 0D85' CO 0B13' LBR INCPPC
2731 ;
2732 0D88' E2      CTCSET: SEX STACK ;SET COUNTER C
2733 ;           SCAL R6, CTNSET
2734 0D89' 68 96    +
2735 0D8B' 0D91'    -
2736 0D8D' 74       DB CTCHI
2737 0D8E' CO 0C00' LBR SAVPPC ;GO TO SAVE PPC
2738 ;
2739 ;
2740 ;***** SET COUNTER (N) SUBROUTINE *****
2741 ;
2742 0D91' 1C      CTNSET: INC PPC  ;INCREMENT PPC
2743 0D92' 46      CDA LIST    ;GET CT(N) HI
2744 0D93' A7      PLO GPAGE
2745 0D94' EC      SEX PPC
2746 0D95' 72      LDXA        ;STORE CT(N) HI
2747 0D96' 57      STR GPAGE
2748 0D97' 17      INC GPAGE
2749 0D98' 72      LDXA        ;STORE CT(N) LO
2750 0D99' 57      STR GPAGE
2751 0D9A' 17      INC GPAGE
2752 0D9B' 72      LDXA        ;STORE CT(N) VECT HI
2753 0D9C' 57      STR GPAGE
2754 0D9D' 17      INC GPAGE
2755 0D9E' 72      LDXA        ;STORE CT(N) VECT LO
2756 0D9F' 57      STR GPAGE
2757 0DA0' E2      SEX STACK
2758 ;           SRET R6  ;RETURN
2759 0DA1' 68 96    +
2760 ;

```

MACRO-18 3.36 PAGE 1-60
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

2761 ;  

2762 ;***** CLEAR COUNTER #N (SUBROUTINE) *****  

2763 ;***** Called by CTAX, CTBX, CTCX *****  

2764 ;  

2765 ODA3' 46 CTNCLR: LDA LIST :GET CT(N) LO ADDRESS  

2766 ODA4' A7 PLO GPAGE ;CLEAR COUNT OF CNT(N)  

2767 ODA5' E7 SEX GPAGE  

2768 ODA6' F8 00 LDI 00  

2769 ODA8' 73 STXD  

2770 ODA9' 73 STXD  

2771 ODAA' E2 SEX STACK  

2772 ODAE' 68 96 SRET R6 ;RETURN FROM SUB  

2773 +  

2774 ;  

2775 ;  

2776 ;  

2777 ;*****  

2778 ;  

2779 ;***** SET UP SEA DATA BUFFER AND RECORD *****  

2780 ;  

2781 JDAD' F8 18 SD: LDI SEC1 ;SEC. = X0?  

2782 ODAF' A7 PLO GPAGE  

2783 JDB0' 07 LDN GPAGE ; IF NOT, RETURN TO LBT  

2784 JDB1' CA 0891' LBNZ SDRET  

2785 JDB4' 17 INC GPAGE ;CYCLES = 1A?  

2786 JDB5' 07 LDN GPAGE  

2787 JDB6' FB 1A XRI 1AB ; IF NOT, RETURN TO LBT  

2788 JDB8' CA 0891' LBNZ SDRET  

2789 ;  

2790 RLDI DMA, BUFFER ;SET UP BUFFER R0 = DMA = 5900  

2791 ODBB' 68 C0 +  

2792 JDBD' 5B00 +  

2793 ;  

2794 ;  

2795 ; TRANSFER DATA FROM GLOBAL PAGE TO DMA BUFFER  

2796 ; DATA IS PACKED DURING TRANSFER  

2797 ;  

2798 ; DO EXP. # AND TIME WORDS FIRST  

2799 ;  

2800 ;  

2801 ODBP' F8 0F LDI EXPNUM ;GP TO EXPNUM (GP = 0F)  

2802 ODC1' A7 PLO GPAGR  

2803 ODC2' E7 SEX GPAGE  

2804 ODC3' 72 LDXA ;LD EXPNUM; GP TO D100 (GP=10)  

2805 ODC4' FE SHL  

2806 ODC5' FE SHL
  
```

MACRO-18 J.36 PAGE 1-61
 SEA DUCT: SD05R9.MAC 16 SEP 36

2807	ODC6'	FE	SHL	
2808	ODC7'	FE	SHL	
2809	ODC8'	F1	OR	
2810	ODC9'	50	STR DMA	; EXPNUM/D100 TO DMA BUFFER 00
2811	ODCA'	10	INC DMA	; DMA BUFFER TO 01
2812	ODCB'	17	INC GPAGE	; GP -> D11
2813	ODCC'	72	LDXA	; LD D10; GP TO D1 (GP=12)
2814	ODCD'	FE	SHL	
2815	ODCE'	FE	SHL	
2816	ODCF'	FE	SHL	
2817	ODD0'	FE	SHL	
2818	ODD1'	F1	OR	
2819	ODD2'	50	STR DMA	; D10/D1 TO DMA BUFFER 01
2820	ODD3'	10	INC DMA	; DMA BUFFER TO 02
2821	ODD4'	17	INC GPAGE	; GP -> D13
2822			;	
2823	ODD5'	72	LDXA	; LD H10;GP TO H1 (GP=14)
2824	ODD6'	F2	SHL	
2825	ODD7'	FE	SHL	
2826	ODD8'	F2	SHL	
2827	ODD9'	FE	SHL	
2828	ODDA'	F1	OR	
2829	ODDB'	50	STR DMA	; HF TO DMA BUFFER 02
2830	ODDC'	10	INC DMA	; DMA BUFFER TO 03
2831	ODDD'	17	INC GPAGE	; GP->M10
2832	ODDE'	72	LDXA	; LD M10;GP TO M1 (GP=16)
2833	ODDF'	FE	SHL	
2834	ODE0'	FE	SHL	
2835	ODE1'	FE	SHL	
2836	ODE2'	FE	SHL	
2837	ODE3'	F1	OR	
2838	ODE4'	50	STR DMA	; MM TO BUFFER 03
2839	ODE5'	10	INC DMA	; DMA BUFFER TO 04
2840	ODE6'	17	INC GPAGE	; GP -> S10
2841	ODE7'	72	LDXA	; LD S10;GP TO S1 (GP=18)
2842	ODE8'	FE	SHL	
2843	ODE9'	FE	SHL	
2844	ODEA'	FE	SHL	
2845	ODEB'	FE	SHL	
2846	ODEC'	F1	OR	
2847	ODED'	50	STR DMA	; SS TO DMA BUFFER 04
2848			;	
2849			;	
2850	ODEE'	10	INC DMA	; DMA BUFFER TO 05
2851	ODEF'	F8 60	LDI PPCHI	
2852	ODP1'	A7	PLO GPAGE	

MACRO-18 3.36 PAGE 1-62
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

2853  ODF2'  72      LDXA      ; LOAD PPCHI (GP=60); GP TO PPCLO (GP=61)
2854  ODF3'  50      STR DMA   ; PPCHI TO DMA BUFFER 05
2855  ODF4'  10      INC DMA   ;     DMA BUFFER TO 06
2856  ODF5'  F0      LDX       ; LOAD PPCLO (GP=61); GP STAYS AT GP=61
2857  ODF6'  50      STR DMA   ; PPCLO TO DMA BUFFER 06
2858  ODF7'  10      INC DMA   ;     DMA BUFFER TO 07
2859
2860
2861      ; PUT STATUS BYTES IN BUFFER
2862
2863  ODF8'  F8 80    LDI ERROR ; SET GLOBAL PAGE TO ERROR (GP=80)
2864  ODF9'  A7      PLO GPAGE
2865  ODFB'  72      LDXA      ; LOAD ERROR (GP=80); GP -> 81
2866  ODFC'  50      STR DMA   ; ERROR WORD TO DMA BUFFER 07
2867  ODFD'  10      INC DMA   ;     DMA BUFFER TO 08
2868
2869  ODFE'  72      LDXA      ; LOAD ACSTAT (GP=81); GP -> 82
2870  ODFF'  50      STR DMA   ; ACOUSTIC STATUS TO DMA BUFFER 08
2871  OEOF'  10      INC DMA   ;     DMA BUFFER TO 09
2872
2873  OEO1'  72      LDXA      ; LOAD SWSTAT (GP=82); GP -> 83
2874  OEO2'  50      STR DMA   ; SWSTAT TO DMA BUFFER 09
2875  OEO3'  10      INC DMA   ;     DMA BUFFER TO 0A
2876
2877  OEO4'  72      LDXA      ; LOAD PODSTAT (GP=83); GP -> 84
2878  OEO5'  50      STR DMA   ; PODSTAT TO DMA BUFFER 0A
2879  OEO6'  10      INC DMA   ;     DMA BUFFER TO 0B
2880
2881  OEO7'  72      LDXA      ; LOAD CMPSS (GP=84); GP -> 85
2882  OEO8'  50      STR DMA   ; COMPASS TO DMA BUFFER 0B
2883  OEO9'  10      INC DMA   ;     DMA BUFFER TO 0C
2884
2885  OEOA'  72      LDXA      ; LOAD HDG (GP=85); GP -> 86
2886  OEOB'  50      STR DMA   ; HEADING TO DMA BUFFER 0C
2887  OEOC'  10      INC DMA   ;     DMA BUFFER TO 0D
2888
2889  OEOD'  72      LDXA      ; LOAD PUMP1 (GP=86); GP -> 87
2890  OEOE'  50      STR DMA   ; PUMP 1 SPEED TO DMA BUFFER 0D
2891  OEOF'  10      INC DMA   ;     DMA BUFFER TO 0E
2892
2893  OEOF'  72      LDXA      ; LOAD PUMP2 (GP=87); GP -> 88
2894  OEOG'  50      STR DMA   ; PUMP 2 SPEED TO DMA BUFFER 0E
2895  OEOH'  10      INC DMA   ;     DMA BUFFER TO 0F
2896
2897  OEOI'  72      LDXA      ; LOAD CAMCNT (GP=88); GP -> 98
2898  OEOJ'  50      STR DMA   ; CAMERA FRAME COUNT TO DMA BUFFER 0F
  
```

MACRO-18 3.36 PAGE 1-63
 SEA DUCT: SD05R9.MAC 16 SEP 86

2999	OE15'	10		INC DMA	; DMA BUFFER TO 10
2900			;		
2901	OE16'	72		LDXA	; LOAD PITCH (GP=89); GP -> 8A
2902	OE17'	50		STR DMA	; PITCH TO DMA BUFFER 10
2903	OE18'	10		INC DMA	; DMA BUFFER TO 11
2904			;		
2905	OE19'	72		LDXA	; LOAD ROLL (GP=8A); GP -> 8B
2906	OE1A'	50		STR DMA	; ROLL TO DMA BUFFER 11
2907	OE1B'	10		INC DMA	; DMA BUFFER TO 12
2908			;		
2909	OE1C'	72		LDXA	; LOAD BATTUP (GP=8B); GP -> 8C
2910	OE1D'	50		STR DMA	; UP BATTERY TO DMA BUFFER 12
2911	OE1E'	10		INC DMA	; DMA BUFFER TO 13
2912			;		
2913	OE1F'	72		LDXA	; LOAD BATTSY (GP=8C); GP -> 8D
2914	OE20'	50		STR DMA	; SYSTEM BATTERY TO DMA BUFFER 13
2915	OE21'	10		INC DMA	; DMA BUFFER TO 14
2916			;		
2917			;		
2918	OE22'	E0		SEX DMA	; START STORING A/D STRING
2919			;		
2920			;		
2921	OE23'	47		LDA GPAGE	; LOAD ADGH8 (GP=8D); GP -> 8E
2922	OE24'	50		STR DMA	; ADGH8 TO DMA BUFFER 14
2923	OE25'	10		INC DMA	; DMA BUFFER TO 15
2924	OE26'	47		LDA GPAGE	; LOAD ADGL4 (GP=8E); GP -> 8F
2925	OE27'	FE		SHL	
2926	OE28'	FE		SHL	
2927	OE29'	FE		SHL	
2928	OE2A'	FE		SHL	
2929	OE2B'	50		STR DMA	; ADGL4/XXXX TO DMA BUFFER 15
2930	OE2C'	07		LDA GPAGE	; LOAD ADRH8 (GP=8F)
2931	OE2D'	F6		SHR	
2932	OE2E'	F6		SHR	
2933	OE2F'	F6		SHR	
2934	OE30'	F6		SHR	
2935	OE31'	F1		OR	
2936	OE32'	50		STR DMA	; ADGL4/ADR4 TO DMA BUFFER 15
2937	OE33'	10		INC DMA	; DMA BUFFER TO 16
2938	OE34'	47		LDA GPAGE	; LOAD ADRH8 (GP=8F); GP -> ADRL4 (GP=90)
2939	OE35'	FE		SHL	
2940	OE36'	FE		SHL	
2941	OE37'	FE		SHL	
2942	OE38'	FE		SHL	
2943	OE39'	50		STR DMA	; ADRM4 TO DMA BUFFER 16
2944			;		

MACRO-18 3.36
PAGE 1-64
SEA DUCT: SD05R9.MAC 16 SEP 86

2945 0E3A' 47 LDA GPAGE ;LOAD ADRL4 (GP=90); GP -> AD5H8 (GP=91)
2946 0E3B' FA OF ANI OFH
2947 0E3D' F1 OR
2948 0E3E' 50 STR DMA ; ADRL8 TO DMA BUFFER 16
2949 0E3F' 10 INC DMA ; DMA BUFFER TO 17
2950 ;
2951 ;DMA = 17 (AD5H8) ;GP = 91 (AD5H8)
2952 ;
2953 0E40' 47 LDA GPAGE ;LOAD AD5H8 (GP=91); GP -> AD5L4 (GP=92)
2954 0E41' 50 STR DMA ;AD5H8 TO DMA BUFFER 17
2955 0E42' 10 INC DMA ; DMA BUFFER TO 18
2956 0E43' 47 LDA GPAGE ;LOAD AD5L4 (GP=92); GP -> XPOS (GP=93)
2957 0E44' FE SHL
2958 0E45' FE SHL
2959 0E46' FE SHL
2960 0E47' FE SHL
2961 0E48' 50 STR DMA ;AD5L4/XXXX TO DMA BUFFER 18
2962 0E49' 47 LDA GPAGE ;LOAD XPOS (GP=93); GP -> YZPOS (GP=94)
2963 0E4A' FA OF ANI OFH
2964 0E4C' F1 OR
2965 0E4D' 50 STR DMA ;AD5L4/XPOS TO DMA BUFFER 13
2966 0E4E' 10 INC DMA ; DMA BUFFER TO 19
2967 0E4F' 47 LDA GPAGE ;LOAD YZPOS (GP=94); GP -> ADT1H8 (GP=95)
2968 0E50' 50 STR DMA ;YZPOS TO DMA BUFFER 19
2969 0E51' 10 INC DMA ; DMA BUFFER TO 1A
2970 ;
2971 ;DO TRANSMISSOMETER STRING: DMA = BUF + 1AH ;GP = 95H
2972 ;
2973 0E52' 47 LDA GPAGE ;LOAD ADT1H8 (GP=95); GP -> ADT1L4 (GP=96)
2974 0E53' 50 STR DMA ;ADT1H8 TO DMA BUFFER 1A
2975 0E54' 10 INC DMA ; DMA BUFFER TO 1B
2976 0E55' 47 LDA GPAGE ;LOAD ADT1L4 GP=96); GP -> ADT2H8 (GP=97)
2977 0E56' FE SHL
2978 0E57' FE SHL
2979 0E58' FE SHL
2980 0E59' FE SHL
2981 0E5A' 50 STR DMA ;ADT1L4/XXXX TO DMA BUFFER 1B
2982 0E5B' 07 LDW GPAGE ;LOAD ADT2H8 (GP=97)
2983 0E5C' F6 SHR
2984 0E5D' F6 SHR
2985 0E5E' F6 SHR
2986 0E5F' F6 SHR
2987 0E60' F1 OR
2988 0E61' 50 STR DMA ;ADT1L4/ADT2H4 TO DMA BUFFER 1B
2989 0E62' 10 INC DMA ; DMA BUFFER TO 1C
2990 0E63' 47 LDA GPAGE ;LOAD ADT2H8 (GP=97); GP -> ADT2L4 (GP=98)

NACRO-18 3.36 PAGE 1-65
SEA DUCT: SD05R9.MAC 16 SEP 86

2991	OE64'	FE	SHL	
2992	OE65'	FE	SHL	
2993	OE66'	FE	SHL	
2994	OE67'	FE	SHL	
2995	OE68'	50	STR DMA	;ADT2N4 TO DMA BUFFER 1C
2996	OE69'	47	LDA GPAGE	;LOAD ADT2L4 (GP=98); GP TO ADT3H8 (GP=99)
2997	OE6A'	FA OF	ANI OFH	
2998	OE6C'	F1	OR	
2999	OE6D'	50	STR DMA	;ADT2L8 TO DMA BUFFER 1C
3000	OE6E'	10	INC DMA	; DMA BUFFER TO 1D
3001				
3002	OE6F'	47	LDA GPAGE	;LOAD ADT3H8 (GP=99); GP TO ADT3L4 (GP=9A)
3003	OE70'	50	STR DMA	;ADT3H8 TO DMA BUFFER 1D
3004	OE71'	10	INC DMA	; DMA BUFFER TO 1E
3005	OE72'	47	LDA GPAGE	;LOAD ADT3L4 (GP=9A); GP TO ADT4H8 (GP=9B)
3006	OE73'	FE	SHL	
3007	OE74'	FE	SHL	
3008	OE75'	FE	SHL	
3009	OE76'	FE	SHL	
3010	OE77'	50	STR DMA	;ADT3L4/XXXX TO DMA BUFFER 1E
3011	OE78'	07	LDA GPAGE	;LOAD ADT4H8 GP=9B
3012	OE79'	F6	SHR	
3013	OE7A'	F6	SHR	
3014	OE7B'	F6	SHR	
3015	OE7C'	F6	SHR	
3016	OE7D'	F1	OR	
3017	OE7E'	50	STR DMA	;ADT3L4/ADT4H4 TO DMA BUFFER 1E
3018	OE7F'	10	INC DMA	; DMA BUFFER TO 1F
3019	OE80'	47	LDA GPAGE	;LOAD ADT4H8 (GP=9B); GP TO ADT4L8 (GP=9C)
3020	OE81'	FE	SHL	
3021	OE82'	FE	SHL	
3022	OE83'	FE	SHL	
3023	OE84'	FE	SHL	
3024	OE85'	50	STR DMA	;ADT4M4/XXXX TO DMA BUFFER 1F
3025	OE86'	47	LDA GPAGE	;LOAD ADT4L8 (GP=9C); GP TO ADT5H8 (GP=9D)
3026	OE87'	FA OF	ANI OFH	
3027	OE89'	F1	OR	
3028	OE8A'	50	STR DMA	;ADT4L8 TO DMA BUFFER 1F
3029	OE8B'	10	INC DMA	; DMA BUFFER TO 20
3030				
3031	OE8C'	47	LDA GPAGE	;LOAD ADT5H8 (GP=9D); GP TO ADT5L4 (GP=9E)
3032	OE8D'	50	STR DMA	;ADT5H8 TO DMA BUFFER 20
3033	OE8E'	10	INC DMA	; DMA BUFFER TO 21
3034	OE8F'	47	LDA GPAGE	;LOAD ADT5L4 (GP=9E); GP TO ADT6H8 (GP=9F)
3035	OE90'	FE	SHL	
3036	OE91'	FE	SHL	

MACRO-18 3.36 PAGE 1-66
SEA DUCT: SD05R9.MAC 16 SEP 86

3037	0E92'	FE	SHL	
3038	0E93'	FE	SHL	
3039	0E94'	50	STR DMA	;ADT5L4/XXXX TO DMA BUFFER 21
3040	0E95'	07	LDN GPAGE	;LOAD ADT6H8 (GP=9F)
3041	0E96'	F6	SHR	
3042	0E97'	F6	SHR	
3043	0E98'	F6	SHR	
3044	0E99'	F6	SHR	
3045	0E9A'	F1	OR	
3046	0E9B'	50	STR DMA	;ADT5L4/ADT6H4 TO DMA BUFFER 21
3047	0E9C'	10	INC DMA	; DMA BUFFER TO 22
3048	0E9D'	47	LDA GPAGE	;LOAD ADT6H8 (GP=9F); GP TO ADT6L4 (GP=A0)
3049	0E9E'	FB	SHL	
3050	0E9F'	FE	SHL	
3051	0EA0'	F2	SHL	
3052	0EA1'	FE	SHL	
3053	0EA2'	50	STR DMA	;ADT6M4/XXXX TO DMA BUFFER 22
3054	0EA3'	47	LDA GPAGE	;LOAD ADT6L4 (GP=A0); GP TO ADT7H8 (GP=A1)
3055	0EA4'	FA OF	ANI OFH	
3056	0EA6'	F1	OR	
3057	0EA7'	50	STR DMA	;ADT6L8 TO DMA BUFFER 22
3058	0EA8'	10	INC DMA	; DMA BUFFER TO 23
3059				
3060				;GP = A1 (ADT7H8); DMA = BUF + 23 (ADT7H8)
3061				;
3062	0EA9'	47	LDA GPAGE	;LOAD ADT7H8 (GP=A1); GP TO ADT7L4 (GP=A3)
3063	0EAA'	50	STR DMA	;ADT7H8 TO DMA BUFFER 23
3064	0EAB'	10	INC DMA	; DMA BUFFER TO 24
3065	0EAC'	47	LDA GPAGE	;LOAD ADT7L4 (GP=A2); GP TO ADT8H8 (GP=A3)
3066	0EAD'	F2	SHL	
3067	0EAE'	FE	SHL	
3068	0EAF'	FE	SHL	
3069	0EB0'	FE	SHL	
3070	0EB1'	50	STR DMA	;ADT7L4/XXXX TO DMA BUFFER 24
3071	0EB2'	07	LDN GPAGE	;LOAD ADT8H8 (GP=A3)
3072	0EB3'	F6	SHR	
3073	0EB4'	F6	SHR	
3074	0EB5'	F6	SHR	
3075	0EB6'	F6	SHR	
3076	0EB7'	F1	OR	
3077	0EB8'	50	STR DMA	;ADT7L4/ADT8H4 TO DMA BUFFER 24
3078	0EB9'	10	INC DMA	; DMA BUFFER TO 25
3079	0EBA'	47	LDA GPAGE	;LOAD ADT8H8 (GP=A3); GP TO ADT8L4 (GP=A4)
3080	0EBB'	FE	SHL	
3081	0EBC'	FE	SHL	
3082	0EBD'	F2	SHL	

MACRO-18 3.36
SEA DUCT: SD05R9.MAC 16 SEP 86

PAGE 1-67

3083	0EBE'	FE	SHL	
3084	0EBF'	50	STR DMA	;ADT8M4/XXXX TO DMA BUFFER 25
3085	0EC0'	47	LDA GPAGE	;LOAD ADT8L4 (GP=A4); GP TO ADT9H8 (GP=A5)
3086	0EC1'	FA 0F	ANI OFH	
3087	0EC3'	F1	OR	
3088	0EC4'	50	STR DMA	;ADT8L8 TO DMA BUFFER 25
3089	0EC5'	10	INC DMA	; DMA BUFFER TO 26
3090			:	
3091	0EC6'	47	LDA GPAGE	;LOAD ADT9H8 (GP=A5); GP TO ADT9L4 (GP=A6)
3092	0EC7'	50	STR DMA	;ADT9H8 TO DMA BUFFER 26
3093	0EC8'	10	INC DMA	; DMA BUFFER TO 27
3094	0EC9'	47	LDA GPAGE	;LOAD ADT9L4 (GP=A6); GP TO ADT0H8 (GP=A7)
3095	0ECA'	FE	SHL	
3096	0ECD'	FE	SHL	
3097	0ECC'	FE	SHL	
3098	0ECD'	FE	SHL	
3099	0ECE'	50	STR DMA	;ADT9L4/XXXX TO DMA BUFFER 27
3100	0ECP'	07	LDM GPAGE	;LOAD ADT0H8 (GP=A7)
3101	0ED0'	F6	SHR	
3102	0ED1'	F6	SHR	
3103	0ED2'	F6	SHR	
3104	0ED3'	F6	SHR	
3105	0ED4'	F1	OR	
3106	0ED5'	50	STR DMA	;ADT9L4/ADT0H4 TO DMA BUFFER 27
3107	0ED6'	10	INC DMA	; DMA BUFFER TO 28
3108	0ED7'	47	LDA GPAGE	;LOAD ADT0H8 (GP=A7); GP TO ADT0L4 (GP=A8)
3109	0ED8'	FE	SHL	
3110	0ED9'	FE	SHL	
3111	0EDA'	FE	SHL	
3112	0EDB'	FE	SHL	
3113	0EDC'	50	STR DMA	;ADT0M4/XXXX TO DMA BUFFER 28
3114	0EDD'	07	LDM GPAGE	;LD ADT0L4 (GP=A8)
3115	0EDE'	FA 0F	ANI OFH	
3116	0EE0'	F1	OR	
3117	0EE1'	50	STR DMA	;ADT0L8 TO DMA BUFFER 28
3118			:	
3119			:	
3120			;DATA IS NOW LOADED INTO DMA BUFFER	
3121			;START RECORDER IF REC. FLG. = AC	
3122			:	
3123	0EE2'	F8 00	LDI 00	;SET DMA TO START OF BUFFER
3124	0EE4'	A0	PLO DMA	
3125	0EE5'	F8 B2	LDI RECFLG	;RECORD IF RECFLG = AC
3126	0EE7'	A7	PLO GPAGE	
3127	0EE8'	07	LDM GPAGE	
3128	0EE9'	FB AC	XRI OACH	

MACRO-18 3.36 PAGE 1-68
SEA DUCT: SD05R9.MAC 16 SEP 86

3129 0EEB' 32 F3' BZ SDREC
3130 0EED' F8 00 LDI 00 ;IF NOT = AC, SET TO 00
3131 0EEF' 57 STR GPAGE
3132 0EF0' C0 0891' LBR SDRET ; AND RETURN TO LBT
3133 ;
3134 0EF3' E1 SDREC: SEX INTPC ;START RECORDING AFTER
3135 0EF4' 61 OUT GROUP
3136 0EF5' 02 DB 02
3137 0EF6' 63 OUT SDREQ ; SENDING RECORD LENGTH
3138 0EF7' 29 DB SDLNGT
3139 0EF8' C0 0891' LBR SDRET ;RETURN TO LBT
3140 ;
3141 ;
3142 ;*****
3143 ;
3144 ;***** PROM 3 *****
3145 ;
3146 ;
3147 ORG (HDSTRT + 1000H)
3148 ;
3149 ;
3150 ;***** HELP FILE *****
3151 ;
3152 1000' HELP: SCAL R6, TTY
3153 1000' 68 86 +
3154 1002' 024E' +
3155 1004' 65 6C 70 3A DB 'elp:'
3156 1008' CA DB OCAH
3157 1009' 53 65 61 20 DB 'Sea Duct '
3158 100D' 44 75 63 74
3159 1011' 20
3160 1012' 56 65 72 73 DB 'Vers. '
3161 1016' 2E 20
3162 1018' 35 DB VERS
3163 1019' 2E DB '.'
3164 101A' 39 DB REV
3165 101B' 00CA DW OCAH
3166 ;
3167 101D' 53 79 73 74 DB 'System Cmds.'
3168 1021' 65 6D 20 43
3169 1025' 6D 64 73 3A
3170 1029' 20 21 55 4E DB '!UNLOCK; !LOCK'
3171 102D' 4C 4F 43 4B
3172 1031' 3B 20 21 4C
3173 1035' 4F 43 4B
3174 1038' CA DB OCAH

MACRO-18 3.36 PAGE 1-69
SEA DUCT: SD05R9.MAC 16 SEP 86

3175	1039'	4D 65 6D 6F	DB 'Memory Commands:'
3176	103D'	72 79 20 43	
3177	1041'	6F 6D 6D 61	
3178	1045'	6E 64 73 3A	
3179	1049'	CA	DB 0CAH
3180	104A'	20 20 21 4D	DB ' !Maaaa dd...;'
3181	104B'	61 61 61 61	
3182	1052'	20 64 64 2E	
3183	1056'	2E 2E 3B	
3184	1059'	20 3F 4D 61	DB ' ?Maaaa nnnn;'
3185	105D'	61 61 61 20	
3186	1061'	6E 6E 6E 6E	
3187	1065'	3B	
3188	1066'	20 3F 43 20	DB ' ?C (CRC)'
3189	106A'	28 43 52 43	
3190	106E'	29	
3191	106F'	CA	DB 0CAH
3192	1070'	20 20 4D 20	DB ' M (Memory protect)'
3193	1074'	28 4D 65 6D	
3194	1078'	6F 72 79 20	
3195	107C'	70 72 6F 74	
3196	1080'	65 63 74 29	
3197	1084'	CA	DB 0CAH
3198		;	
3199	1085'	43 6C 6F 63	DB 'Clock Commands:'
3200	1089'	6B 20 43 6F	
3201	108D'	6D 6D 61 6E	
3202	1091'	64 73 3A	
3203	1094'	20 3F 54 3B	DB ' ?T; '
3204	1098'	20	
3205	1099'	21 54 49 4D	DB ' !TIME DDDHHMMSS @'
3206	109D'	45 20 44 44	
3207	10A1'	44 48 48 4D	
3208	10A5'	4D 53 53 20	
3209	10A9'	40	
3210	10AA'	CA	DB 0CAH
3211		;	
3212	10AB'	50 61 73 73	DB 'Pass Thru Mode:'
3213	10AF'	20 54 68 72	
3214	10B3'	75 20 4D 6F	
3215	10B7'	64 65 3A	
3216	10BA'	20 25 50 3B	DB ' \$P; \$R; \$X; \$B'
3217	10BE'	20 25 52 3B	
3218	10C2'	20 25 58 3B	
3219	10C6'	20 25 42	
3220	10C9'	CA	DB 0CAH

MACRO-18 3.36 PAGE 1-70
SEA DUCT: SD05R9.MAC 16 SEP 86

3221 ;
3222 10CA' 53 65 71 75 ; DB 'Sequencer Cmds:'
3223 10CE' 65 6E 63 65
3224 10D2' 72 20 43 6D
3225 10D6' 64 73 3A
3226 10D9' CA ; DB 00CAH
3227 10DA' 20 20 3F 53 ; DB ' ?S; !S; !F (Follow PPC)'
3228 10DE' 3B 20 21 53
3229 10E2' 3B 20 21 46
3230 10E6' 20 28 46 6F
3231 10EA' 6C 6C 6F 77
3232 10EE' 20 50 50 43
3233 10F2' 29
3234 10F3' CA ; DB 0CAH
3235 ;
3236 10F4' 20 20 4D 61 ; DB ' Main Sequencer PPC Starts at 3000'
3237 10F8' 69 6E 20 53
3238 10FC' 65 71 75 65
3239 1100' 6B 63 65 72
3240 1104' 20 50 50 43
3241 1108' 20 53 74 61
3242 110C' 72 74 73 20
3243 1110' 61 74 20 33
3244 1114' 30 30 30
3245 1117' CA ; DB 0CAH
3246 ;
3247 1118' 53 65 61 20 ; DB 'Sea Duct Cmds:'
3248 111C' 44 75 63 74
3249 1120' 20 43 6D 64
3250 1124' 73 3A
3251 1126' CA ; DB 0CAH
3252 1127' 20 20 3F 48 ; DB ' ?H; !H (Read or Set Exp. Hdg.)'
3253 112B' 3B 20 21 48
3254 112F' 20 28 52 65
3255 1133' 61 64 20 6F
3256 1137' 72 20 53 65
3257 113B' 74 20 45 78
3258 113F' 70 2E 20 48
3259 1143' 64 67 2B 29
3260 1147' CA ; DB 0CAH
3261 1148' 20 20 3F 45 ; DB ' ?E; !E (Read or Set Exp. #)'
3262 114C' 3B 20 21 45
3263 1150' 20 28 52 65
3264 1154' 61 64 20 6F
3265 1158' 72 20 53 65
3266 115C' 74 20 45 78

MACRO-18 3.36 PAGE 1-71
 SEA DUCT: SD05R9.MAC 16 SEP 96

```

3267 1160' 70 2E 20 23
3268 1164' 29
3269 1165' CA          DB OCAB
3270 1166' 20 20 3F 42  DB ' ?B (?Buffer)'
3271 116A' 20 28 3F 42
3272 116E' 75 66 66 65
3273 1172' 72 29
3274 ;
3275 1174' FF          DB DONE
3276 1175' C0 0107'    LBR PROMPT
3277 ;
3278 ;
3279 ;***** ? BUFFER (INSTRUMENT SPECIFIC) *****
3280 ;
3281 1178'             QUEBUF: SCAL R6, TTY ;TYPE "uffer CR,LF
3282 1178' 68 86        +
3283 117A' 024E'        +
3284 117C' 20 20 57 41  DB ' WAIT...
3285 1180' 49 54 2E 2E
3286 1184' 2E
3287 1185' CAFF        DW OCABFH
3288 ;
3289 1187' F8 18        LDI SEC1 ; WAIT FOR SEC = 0
3290 1189' A7           PLO GPAGE
3291 ;
3292 118A' 07           LDN GPAGE
3293 118B' FA 0F         ANI OFH
3294 118D' 3A 3A'        BNZ $-03
3295 ;
3296 118F' 17           INC GPAGE ;SET GP = CYCLES
3297 1190' 07           LDN GPAGE ; WAIT FOR CYCLES = 1B
3298 1191' FB 1B         XRI 1BH
3299 1193' 3A 90'        BNZ $-03
3300 ;RLDI RD, BUFFER ;SET UP RD TO START OF
3301 1195' 68 CD        +
3302 1197' 5B00        +
3303 ; ; SEA DATA BUFFER
3304 ;
3305 ;SCAL R6, TTY ;TYPE: (FIRST LINE)
3306 1199' 68 86        +
3307 119B' 024E'        +
3308 119D' CA           DB OCAB
3309 119E' 42 75 66 66  DB 'Buffer:'
3310 11A2' 65 72 3A
3311 11A5' CA           DB OCAB
3312 11A6' 45 58 50 23  DB 'EXP# ' ;FIRST LINE:
  
```

MACRO-18 3.36 PAGE 1-72
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

3313 11AA' 20
3314 11AB' A1
3315 11AC' 20 20 DB 0A1H ; OUTPUT 4 BIT EXPERIMENT #
3316 11AE' A2 DB ' '
3317 11AF' 8D DB 0A2H ; OUTPUT 3 DIGIT DAYS
3318 11B0' 2F DB 08DH
3319 ;
3320 11B1' 8D DB 08DH ;OUTPUT TIME
3321 11B2' 3A DB ':'
3322 11B3' 8D DB 08DH
3323 11B4' 3A DB ':'
3324 11B5' 8D DB 08DH
3325 ;
3326 11B6' 20 20 20 50 DB ' PPC=' ;OUTPUT SEQUENCER PPC
3327 11BA' 50 43 3D
3328 11BD' 8D DB 08DH
3329 11BE' 8D DB 08DH
3330 ;
3331 11BF' CA DB 0CAH
3332 ;
3333 ;
3334 11C0' 45 52 52 3D DB 'ERR=' ; ERROR WORD
3335 11C4' 8D DB 08DH
3336 11C5' 20 20 41 43 DB ' ACU=' ; ACOUSTIC STATUS
3337 11C9' 55 3D
3338 11CB' 8D DB 08DH
3339 11CC' 20 20 53 57 DB ' SW=' ; SWITCH STATUS
3340 11D0' 3D
3341 11D1' 8D DB 08DH
3342 11D2' 20 20 50 4F DB ' POD='
3343 11D6' 44 3D
3344 11D8' 8D DB 08DH ; RELAY POD STATUS
3345 11D9' 20 20 43 4D DB ' CMPS='
3346 11DD' 50 53 3D
3347 11E0' 8DCAH DW 08DCAH ; COMPASS, CR, LF
3348 ;
3349 ;
3350 11E2' 48 44 47 3D DB 'HDG=' ;THIRD LINE:
3351 11E6' 8D DB 08DH
3352 11E7' 20 20 20 50 DB ' P1='
3353 11EB' 31 3D
3354 11ED' 8D DB 08DH ; PUMP 1 SPEED
3355 11EE' 20 20 50 32 DB ' P2='
3356 11F2' 3D
3357 11F3' 8D DB 08DH ; PUMP 2 SPEED
3358 11F4' 20 20 43 41 DB ' CAM='
  
```

MACRO-18 3.36 PAGE 1-73
 SEA DUCT: SD05R9.MAC 16 SEP 86

3359	11F8'	4D 3D		
3360	11FA'	SDCA	DW 08DCAH	; CAMERA FRAME COUNT, CR, LF
3361			;	
3362			;	;FOURTH LINE:
3363	11FC'	50 49 54 43	DB 'PITCH='	
3364	1200'	48 3D	DB 08DH	; PITCH
3365	1202'	8D	DB ' ROLL='	
3366	1203'	20 20 52 4F	DB 08DH	; ROLL
3367	1207'	4C 4C 3D	DB ' uP Bat='	
3368	120A'	008D	DB 08DH	; COMPUTER BATTERY
3369	120C'	20 20 75 50	DB ' SysBat='	
3370	1210'	20 42 61 74		
3371	1214'	3D		
3372	1215'	8D		
3373	1216'	20 20 53 79		
3374	121A'	73 42 61 74		
3375	121B'	3D		
3376	121F'	8DCA	DW 08DCAH	; SYSTEM BATTERY, CR, LF
3377			;	
3378			;	;FIFTH LINE:
3379	1221'	47 4E 44 3D	DB 'GND='	
3380	1225'	8DA1	DW 08DA1H	; A/D GND REF (12 BIT)
3381	1227'	20 20 52 45	DB ' REF='	
3382	1228'	46 3D		
3383	122D'	A28D	DB 0A28DH	; A/D REF (12 BIT)
3384	122F'	20 20 2B 35	DB ' +5V='	
3385	1233'	56 3D		
3386	1235'	8DA1	DW 08DA1H	; A/D +5V (12 BIT)
3387	1237'	CA	DB 0CAH	; CR, LF
3388			;	
3389			;	;SIXTH LINE:
3390	1238'	58 50 4F 53	DB 'XPOS='	
3391	123C'	3D		
3392	123D'	A2	DB 0A2H	; XPOS (4 BIT)
3393	123E'	20 20 20 59	DB ' YPOS='	
3394	1242'	50 4F 53 3D		
3395	1246'	A1	DB 0A1H	; YPOS (4 BIT)
3396	1247'	20 20 20 5A	DB ' ZPOS='	
3397	1248'	50 4F 53 3D		
3398	124F'	A2CA	DW 0A2CAH	; ZPOS (4 BIT), CR, LF
3399			;	
3400			;	;SEVENTH LINE:
3401	1251'	8DA1	DW 08DA1H	; T1
3402	1253'	20	DB ''	
3403	1254'	A28D	DW 0A28DH	; T2
3404	1256'	20	DB ''	

MACRO-18 3.36 PAGE 1-74
SEA DUCT: SD05R9.MAC 16 SEP 36

3405	1257'	8DA1	DW 08DA1H	; T3
3406	1259'	20	DB ''	
3407	125A'	A28D	DW 0A28DH	; T4
3408	125C'	20	DB ''	
3409	125D'	8DA1	DW 08DA1H	; T5
3410			;	
3411	125F'	2F	DB ''	; /
3412			;	
3413	1260'	A28D	DW 0A28DH	; T6
3414	1262'	20	DB ''	
3415	1263'	8DA1	DW 08DA1H	; T7
3416	1265'	20	DB ''	
3417	1266'	A28D	DW 0A28DH	; T8
3418	1268'	20	DB ''	
3419	1269'	8DA1	DW 08DA1H	; T9
3420	126B'	20	DB ''	
3421	126C'	A28D	DW 0A28DH	; T10
3422			;	
3423	126E'	0OFF	DW DONE	; DONE
3424			;	
3425	1270'	C0 0107'	LBR PROMPT	
3426			;	
3427			;	
3428			***** SET EXPERIMENT HEADING VALUE *****	
3429			;	
3430	1273'		HDGSET: SCAL R6, TTY	
3431	1273'	68 86	;	
3432	1275'	024E'	;	
3433	1277'	65 61 64 69	DB 'eading (HX) Flow from = ? '	
3434	1278'	6E 67 20 28		
3435	127E'	48 58 29 20		
3436	1283'	20 46 6C 6F		
3437	1287'	77 20 66 72		
3438	128B'	6F 6D 20 3D		
3439	1287'	20 3F 20		
3440	1292'	03	DB 03H	; ETX
3441	1293'	9D	DB 9DH	; IN4D
3442	1294'	FF	DB DONE	; DONE
3443			;	
3444	1295'	F8 3F	LDI HDGEXP	;SET GPAGE TO HEADING LOCATION
3445	1297'	A7	PLO GPAGE	
3446	1298'	8D	GLO RD	
3447	1299'	57	STR GPAGE	
3448	129A'	C0 0107'	LBR PROMPT	;RETURN TO PROMPT
3449			;	
3450			;	

MACRO-18 3.36 PAGE 1-75
SEA DUCT: SD05R9.MAC 16 SEP 86

3451 ;***** READ EXPERIMENT HEADING VALUE *****
3452 ;
3453 129D' F8 0F HDG?: LDI HDGEXP ;SET RD = HDGEXP LOCATION
3454 129F' AD PLO RD
3455 12A0' 97 GHI GPAGE
3456 12A1' BD PHI RD
3457 ;
3458 SCAL R6, TTY
3459 12A2' 68 36 +
3460 12A4' 024E' + DB 'eading = '
3461 12A6' 65 61 64 69
3462 12AA' 6E 67 20 3D
3463 12AE' 20
3464 12AF' 8D DB SDH ;OUT EX PR
3465 12B0' 20 28 48 58 DB '(BX)'
3466 12B4' 29
3467 12B5' FF DB DONE ;DONE
3468 12B6' C0 0107' LBR PROMPT
3469 ;
3470 ;
3471 ;***** SET EXPERIMENT NUMBER *****
3472 ;
3473 12B9' EXPSET: SCAL R6, TTY
3474 12B9' 68 36 +
3475 12BB' 024E' + DB 'xp. # (1 Char.) = ? '
3476 12BD' 78 70 28 20
3477 12C1' 23 20 28 31
3478 12C5' 20 43 58 61
3479 12C9' 72 2E 29 20
3480 12CD' 3D 20 3F 20
3481 12D1' 03 DB 03H ;ETX
3482 12D2' 9D DB 9DH ;IN4D
3483 12D3' FF DB DONE ;DONE
3484 ;
3485 12D4' F8 0F LDI EXPNUM ;SET GPAGE TO EXPERIMENT NUMBER LOCATION
3486 12D6' A7 PLO GPAGE
3487 12D7' 8D GLO RD
3488 12D8' 57 STR GPAGE
3489 12D9' C0 0107' LBR PROMPT ;RETURN TO PROMPT
3490 ;
3491 ;
3492 ;***** READ EXPERIMENT NUMBER (4 BIT) *****
3493 ;
3494 12DC' F8 0F EXP?: LDI EXPNUM ;SET RD = EXPNUM LOCATION
3495 12DE' AD PLO RD
3496 12DF' 97 GHI GPAGE

MACRO-18 3.36 PAGE 1-76
SEA DUCT: SD05R9.MAC 16 SEP 86

3497 12E0' BD PHI RD
3498 ;
3499 SCAL R6, TTY
3500 12E1' 68 36 +
3501 12E3' 024E' +
3502 12E5' 78 70 2E 20 DB 'xp. #'
3503 12E9' 23 20
3504 12EB' A2 DB 0A2H ;OUT LOW NIBBLE OF EXPNUM
3505 12EC' FF DB DONE ;DONE
3506 12ED' C0 0107' LBR PROMPT
3507 ;
3508 ;
3509 ;***** COMPASS ROUTINE *****
3510 ; ENTERS FROM LONG BRANCH TABLE
3511 ;
3512 12F0' F8 18 CNPSRD: LDI SEC1 ;RUN ONLY ON SEC = X1
3513 12F2' A7 PLO GPAGE
3514 12F3' 07 LDN GPAGE
3515 12F4' FA 0F ANI OPH
3516 12F6' FB 01 XRI 01
3517 12F8' CA 0879' LBNZ CMPRTN
3518 12FB' 17 INC GPAGE ;SET GPAGE = CYCLES
3519 12FC' 07 LDN GPAGE ;START ONLY IF CYCLES = 0A
3520 12FD' FB 0A XRI 0AH
3521 12FF' C2 1312' LBZ CMPPWR
3522 1302' FB 01 XRI (0BH XOR 0AH) ;READ IF CYCLES = 0B
3523 1304' CA 0879' LBNZ CMPRTN
3524 ;
3525 1307' E1 SEX INTPC ;READ THE COMPASS
3526 1308' 61 OUT GROUP
3527 1309' 01 DB 01
3528 130A' F8 84 LDI CMPSS
3529 130C' A7 PLO GPAGE
3530 130D' E7 SEX GPAGE
3531 130E' 6A INP CMPPASS
3532 130F' C0 0879' LBR CMPRTN ;RETURN TO LST
3533 ;
3534 1312' E1 CNPPWR: SEX INTPC ;FIRE UP THE COMPASS
3535 1313' 61 OUT GROUP
3536 1314' 01 DB 01
3537 1315' 62 OUT CMPPASS
3538 1316' 00 DB 00
3539 1317' C0 0879' LBR CMPRTN ;RETURN TO LST
3540 ;
3541 ;
3542 ;

MACRO-18 3.36 PAGE 1-77
SEA DUCT: SD05R9.MAC 16 SEP 86

3543 ;***** READ SWITCH ROUTINE *****
3544 ; ENTERS FROM LONG BRANCH TABLE
3545 ;
3546 ;
3547 131A' F8 19 SWRD: LDI CYCLES ;RUNS EVERY SEC.
3548 131C' A7 PLO GPAGE
3549 131D' 07 LDN GPAGE ;START ONLY IF CYCLES = 24H
3550 131E' F8 24 XRI 024H
3551 1320' 32 37' BZ SWPWR
3552 1322' FB 01 XRI (024H XOR 025H) ;READ ONLY IF CYCLES = 24H
3553 1324' CA 087C' LBNZ SWRTN
3554 ;
3555 1327' B1 SEX INTPC
3556 1328' 61 OUT GROUP
3557 1329' 00 DB 00
3558 132A' F8 82 LDI SWSTAT ;INPUT SWITCH STATUS TO
3559 132C' A7 PLO GPAGE ; GLOBAL PAGE AT SWSTAT
3560 132D' E7 SEX GPAGE
3561 132E' 6A INP SWITCH ; Bot | ; |Ins0 || Ins4 | Ins3 | Ins2 , Ins1 .
3562 ;
3563 132F' B1 SEX INTPC
3564 1330' 61 OUT GROUP
3565 1331' 02 DB 02 ;TURN OFF BOTTOM SW. DRIVE PWR.
3566 1332' 67 OUT RELAYS
3567 1333' 0D DB 015Q
3568 1334' C0 087C' LBR SWRTN ;RETURN TO LBT
3569 ;
3570 1337' B1 SWPWR: SEX INTPC
3571 1338' 61 OUT GROUP ;TURN ON BOTTOM SW. DRIVE PWR.
3572 1339' 02 DB 02
3573 133A' 67 OUT RELAYS
3574 133B' 4D DB 115Q
3575 133C' C0 087C' LBR SWRTN ;RETURN TO LBT
3576 ;
3577 ;
3578 ;
3579 ;***** A/D CONTROL *****
3580 ; ENTERS FROM LONG BRANCH TABLE
3581 ;
3582 ;
3583 133F' F8 18 AD: LDI SEC1 ;RUNS ONLY ON SEC = 0
3584 1341' A7 PLO GPAGE
3585 1342' 07 LDN GPAGE
3586 1343' FA 0F ANI OPN ;MASK FOR LO BYTE
3587 1345' CA 087F' LBNZ ADRTN ; IF NOT = 0, RETURN TO LBT
3588 1348' F8 B0 LDI ADFLG ;A/D FLAG = AC?

MACRO-18 3.36 PAGE 1-78
 SEA DUCT: SD05R9.MAC 16 SEP 86

3589	134A'	A7	PLO GPAGE
3590	134B'	07	LDN GPAGE
3591	134C'	FB AC	XRI OACH
3592	134E'	C2 1367'	LBZ ADGO
3593			;
3594	1351'	F8 00	LDI 00 ; IF NOT AC, SET FLAG = 00
3595	1353'	57	STR GPAGE
3596	1354'	F8 92	LDI AD5L4 ; AND CLEAR A/D STORAGE
3597	1356'	A7	PLO GPAGE ; LOCATIONS ON GPAGE
3598	1357'	E7	SEX GPAGE
3599	1358'	F8 00	LDI 00
3600	135A'	73	STXD
3601	135B'	73	STXD
3602	135C'	73	STXD
3603	135D'	73	STXD
3604	135E'	73	STXD
3605	135F'	73	STXD
3606	1360'	73	STXD
3607	1361'	73	STXD
3608	1362'	73	STXD
3609	1363'	57	STR GPAGE
3610	1364'	C0 087F'	LBR ADRTN ;RETURN TO LBT
3611			;
3612	1367'	F8 19	ADGO: LDI CYCLES ;IP AC, CONTINUE
3613	1369'	A7	PLO GPAGE ;IF CYCLES NOT = 0,
3614	136A'	07	LDN GPAGE ; DO NOT RESET POINTERS
3615	136B'	3A 7B'	BNZ S+10H ;IF = 0:
3616	136D'	F8 AD	LDI MUXPTR ; RESET MUX LIST POINTER
3617	136F'	A7	PLO GPAGE
3618	1370'	F8 00'	LDI LOW(MUXLST)
3619	1372'	57	STR GPAGE
3620	1373'	17	INC GPAGE ; RESET MEM LIST POINTER
3621	1374'	F8 80'	LDI LOW(MEMLST)
3622	1376'	57	STR GPAGE
3623	1377'	F8 19	LDI CYCLES
3624	1379'	A7	PLO GPAGE
3625	137A'	07	LDN GPAGE
3626			;
3627	137B'	FF 16	SMI 16H ;IF CYCLES > 15H,
3628	137D'	38 84'	BMP S+07H ; (BORROW => DF = 0)
3629	137F'	FC 00	ADI 00 ; CLR DF
3630	1381'	C0 087F'	LBR ADRTN ; RETURN TO LBT
3631			;
3632	1384'	E1	SEX INTPC ;IF CYCLES < 16 :
3633	1385'	61	OUT GROUP ; SELECT MUX GROUP
3634	1386'	02	DB 02 ; CONTROL MUX

MACRO-18 3.36
SEA DUCT: SD05R9.MAC 16 SEP 86

PAGE 1-79

3635	1387'	F8 AD	LDI MUXPTR	; WITH MUX LIST
3636	1389'	A7	PLO GPAGE	
3637	138A'	07	LDN GPAGE	
3638	138B'	AA	PLO RA	
3639	138C'	F8 17'	LDI HIGH(MUXLST)	
3640	138E'	BA	PFI RA	
3641	138F'	EA	SEX RA	
3642	1390'	62	OUT MUX	; (OUT MUX INCREMENTS RA)
3643	1391'	62	OUT MUX	
3644	1392'	3A	GLO RA	; STORE MUX LIST ADDR
3645	1393'	57	STR GPAGE	; AT GP = MUXPTR
3646				
3647	1394'	F8 19	LDI CYCLES	; IF CYCLES < 9 :
3648	1396'	A7	PLO GPAGE	; RETURN TO LBT
3649	1397'	07	LDN GPAGE	
3650	1398'	FF 08	SMI 08H	
3651	139A'	CB 087F'	LBNF ADRTN	
3652				
3653	139D'	07	LDN GPAGE	; IF CYCLES > 8 :
3654	139E'	F6	SHR	
3655	139F'	33 A4'	BDF \$+5	
3656	13A1'	CO 087F'	LBR ADRTN	; RETURN TO LBT ON EVEN CYCLES
3657				
3658	13A4'	F8 AE	LDI MEMPTR	; ON ODD CYCLES :
3659	13A6'	A7	PLO GPAGE	; READ A/D AND STORE AT
3660	13A7'	07	LDN GPAGE	; GPAGE LOCATION REFERENCED
3661	13A8'	AA	PLO RA	; BY MEMLST
3662	13A9'	0A	LDN RA	
3663	13AA'	A7	PLO GPAGE	
3664	13AB'	E7	SEX GPAGE	
3665	13AC'	6B	INP ADH18	; X=GPAGE; HI 8 BITS TO
3666	13AD'	1A	INC RA	; GPAGE STORAGE
3667	13AE'	0A	LDN RA	
3668	13AF'	A7	PLO GPAGE	
3669	13B0'	6A	INP ADL04	; LO 8 BITS TO NULL LOCATION
3670	13B1'	1A	INC RA	
3671	13B2'	F8 AE	LDI MEMPTR	; STORE MEM LIST POINTER
3672	13B4'	A7	PLO GPAGE	; ON GPAGE AT MEMPTR
3673	13B5'	3A	GLO RA	
3674	13B6'	57	STR GPAGE	
3675	13B7'	CO 087F'	LBR ADRTN	; RETURN TO LBT
3676				
3677				
3678				***** TRANSMISSOMETER CONTROL *****
3679				ENTERS FROM LONG BRANCH TABLE
3680				

MACRO-18 3.36
SEA DUCT: SD05R9.NAC 16 SEP 86

PAGE 1-80

3681	13BA'	E1	TR:	SEX INTPC	;TR FLAG = AC?
3682	13BB'	F8 B1		LDI TRFLG	
3683	13BD'	A7		PLO GPAGE	
3684	13BE'	07		LDN GPAGE	
3685	13BF'	FB AC		XRI 0ACH	;IF = AC, GO TO TRCY02
3686	13C1'	C2 13EF'		LBNZ TRCY02	
3687			:		;IF NOT = AC:
3688	13C4'	F8 18		LDI SEC1	
3689	13C6'	A7		PLO GPAGE	; SEC =1 ?
3690	13C7'	07		LDN GPAGE	
3691	13C8'	FA OF		ANI OFH	
3692	13CA'	FB 01		XRI 01	; IF SEC NOT = X1
3693	13CC'	CA 0882'		LBNZ TRRTN	; RETURN TO LBT
3694			:		
3695	13CF'	17		INC GPAGE	; CYCLES = 03 ?
3696	13D0'	07		LDN GPAGE	
3697	13D1'	FB 03		XRI 03H	; IF CYCLES NOT = 03
3698	13D3'	CA 0882'		LBNZ TRRTN	; RETURN TO LBT
3699			:		
3700	13D6'	61		OUT GROUP	; SELECT RELAYS GROUP
3701	13D7'	02		DB 02	
3702	13D8'	67		OUT RELAYS	
3703	13D9'	04		DB 04H	; TRANSMISSOMTER PWR OFF
3704	13DA'	F8 B1		LDI TRFLG	
3705	13DC'	A7		PLO GPAGE	; SET TRFLG = 30
3706	13DD'	F8 00		LDI 00	
3707	13DF'	57		STR GPAGE	
3708			:		
3709	13E0'	F8 A8		LDI ADTOL4	; CLEAR TRANSMISSOMETER
3710	13E2'	A7		PLO GPAGE	A/D LOCATIONS ON GPAGE
3711	13E3'	57		SEX GPAGE	
3712	13E4'	F8 00		LDI 00	
3713	13E6'	73		STXD	
3714	13E7'	87		GLO GPAGE	
3715	13E8'	FF 95		SMI ADT1H8	
3716	13EA'	33 E4'		SDF S-06H	
3717	13EC'	CO 0882'		LBR TRRTN	; RETURN TO LBT
3718			:		
3719	13EF'	F8 19	TRCY02:	LDI CYCLES	; CYCLES = ?
3720	13F1'	A7		PLO GPAGE	
3721	13F2'	07		LDN GPAGE	
3722	13F3'	FB 02		XRI 02H	
3723	13F5'	CA 13FF'		LBNZ TRCY17	; IF NOT = 2, GO TO TRCY17
3724	13F8'	61		OUT GROUP	; IF = 2:
3725	13F9'	02		DB 02	; SELECT RELAYS GROUP
3726	13FA'	67		OUT RELAYS	

MACRO-18 3.36 PAGE 1-81
SEA DUCT: SDQ5R9.MAC 16 SEP 86

3727 13FF' 44 DB 1040 ; TRANSMISSOMETER PWR ON
3728 13FC' C0 0882' LBR TRRTN ; RETURN TO LBT
3729 ;
3730 13FF' FB 15 TRCY17: XRI (02H XOR 17H) ; CYCLES = 17?; IF NO GO TO TRCY18
3731 1401' 3A 0A' BNZ TRCY18 ; IF = 17:
3732 1403' 61 OUT GROUP ; SELECT MUX GROUP
3733 1404' 02 DB 02H ; (R(X)=INTPC)
3734 1405' 62 OUT MUX ; A/D = PWR ON
3735 1406' 72 DB 72H ; MUX = TRANSMISSOMETER
3736 1407' C0 0882' LBR TRRTN ; RETURN TO LBT
3737 ;
3738 140A' FB 0F TRCY18: XRI (17H XOR 18H) ; CYCLES = 19?
3739 140C' CA 1418' LBNZ TRCY19 ; IF NOT, GO TO TRCY19
3740 140F' 61 OUT GROUP ; IF CYCLES = 18
3741 1410' 02 DB 02H ; SELECT MUX GROUP
3742 1411' 62 OUT MUX ; A/D = START CNVRT
3743 1412' 73 DB 73H ; MUX = TRANSMISSOMETER
3744 1413' 62 OUT MUX
3745 1414' 72 DB 72H ; A/D = PWR ON
3746 1415' C0 0882' LBR TRRTN ; GO TO LBT
3747 ;
3748 1418' FB 01 TRCY19: XRI (18H XOR 19H) ; CYCLES = 19H?
3749 141A' CA 0882' LBNZ TRRTN ; IF NOT RETURN TO LBT
3750 141B' 27 DEC GPAGE ; IF = 19: SET GP-> SEC1
3751 141B' 07 LDN GPAGE ; LOOK AT SEC1
3752 141F' FA 0F ANI 0FH ; IF 0, STORE A/D AT GP = ADT0H8, ADT0L4
3753 1421' 3A 27' BNZ \$+06
3754 1423' F8 A7 LDI ADT0H8
3755 1425' 30 2B' BR \$+06H
3756 1427' 07 LDN GPAGE ; IF SEC1 NOT = 0; LOAD SEC.
3757 1428' FE SEL ; SEC. * 2
3758 1429' FC 93 ADI (ADT1H8)-02H ; STORE A/D HI 8 BITS AT
3759 142B' A7 PLO GPAGE ; GP= 2(SEC1) + ADT1H8 - 02H
3760 142C' 21 SEX INTPC
3761 142D' 61 OUT GROUP
3762 142E' 02 DB 02
3763 142F' E7 SEX GPAGE
3764 1430' 6B INP ADH18
3765 1431' 60 IRX ; STORE A/D LO 4 BITS AT
3766 1432' 6A INP ADL04 ; GP= 2(SEC1) + ADT1H8 - 01H
3767 1433' E1 SEX INTPC
3768 1434' 61 OUT GROUP ; SELECT MUX GROUP
3769 1435' 02 DB 02 ; A/D = ON
3770 1436' 62 OUT MUX ; MUX = PENDULUM 1
3771 1437' 00 DB 00
3772 1438' C0 0882' LBR TRRTN ; RETURN TO LBT

MACRO-18 3.36 PAGE 1-82
 SEA DUCT: SD05R9.MAC 16 SEP 86

```

3773      ;  

3774      ;  

3775      ; ***** RELAY POD AND ACOUSTIC LINK CHECK *****  

3776      ; **** RUNS EACH SEC. ON CYCLE = 27H ****  

3777      ;  

3778 143B' F8 19 PDCHK: LDI CYCLES ;RUN ONLY ON CYCLE 27H 39 dec. (Last cycle)  

3779 143D' A7 PLO GPAGE  

3780 143E' 07 LDW GPAGE  

3781 143F' FB 27 XRI 27H  

3782 1441' CA 0885' LBNZ PDRTN ;RETURN TO LBT IF CYCLE NOT = 27H  

3783      ;  

3784 1444' F8 18 LDI SEC1 ;IF Sec = n0, reset PDSTAT, ACSTAT  

3785 1446' A7 PLO GPAGE  

3786 1447' 07 LDW GPAGE  

3787 1448' FA 0F ANI OFH  

3788 144A' CA 145F' LBNZ PDSTR ; IF SEC. not = n0, GO TO PDSTR  

3789      ;  

3790 144D' E1 PDCLR: SEX INTPC  

3791 144E' 61 OUT GROUP ; SET RELAY GROUP  

3792 144F' 02 DB 02 ; GROUP 2  

3793 1450' F8 83 LDI PDSTAT ;CLEAR POD STATUS (Sec.=n9)  

3794 1452' A7 PLO GPAGE  

3795 1453' F8 00 LDI 00  

3796 1455' 57 STR GPAGE  

3797      ;  

3798 1456' E1 ACUCLR: SEX INTPC  

3799 1457' 61 OUT GROUP ; SET GROUP 0  

3800 1458' 00 DB 00  

3801 1459' F8 81 LDI ACSTAT ;CLEAR ACOUSTIC STATUS (Sec.=n9)  

3802 145B' A7 PLO GPAGE  

3803 145C' F8 00 LDI 00  

3804 145E' 57 STR GPAGE  

3805      ;  

3806 145F' E1 PDSTR: SEX INTPC ;CHECK RELAY PODS FOR ACTIVE RELAYS  

3807 1460' 61 OUT GROUP ; SET RELAY GROUP  

3808 1461' 02 DB 02 ; GROUP 2  

3809      ;  

3810 1462' F8 83 LDI PDSTAT  

3811 1464' A7 PLO GPAGE  

3812 1465' 22 SEX STACK ;Input POD STATUS  

3813 1466' 6P INP RELAYS  

3814 1467' E7 SEX GPAGE  

3815 1468' F1 OR ;OR with existing data  

3816 1469' 57 STR GPAGE ;store in PDSTAT on GPAGE  

3817      ;  

3818      ;
  
```

MACRO-18 3.36
SEA DUCT: SD05R9.MAC 16 SEP 86

PAGE 1-83

3819 146A' E1 ACSTR: SEX INTPC ;CHECK ACOUSTIC LINK FOR ACTIVE INPUT
3820 146B' 61 OUT GROUP ; SET GROUP 0
3821 146C' 00 DB 00
3822 ;
3823 146D' F8 81 LDI ACSTAT
3824 146F' A7 PLO GPAGE
3825 1470' E2 SEX STACK ;INPUT ACOUSTIC LINK
3826 1471' 6F INP PING
3827 1472' E7 SEX GPAGE
3828 1473' F1 OR ;OR W/ EXISTING DATA
3829 1474' 57 STR GPAGE ;STORE IN ACSTAT ON GPAGE
3830 ;
3831 ;
3832 1475' C0 0885' LBR PDRTN ;RETURN TO LBT
3833 ;
3834 ;
3835 ;***** READ HEADING *****
3836 ; ENTERS FROM LONG BRANCH TABLE
3837 ;
3838 1478' F8 B3 HDGCHK: LDI HDGFLG ;CHECK HDG FLAG STATUS:
3839 147A' A7 PLO GPAGE ; AC = TURN ON HEADING INDICATOR PWR
3840 147B' 07 LDN GPAGE ; (USED BY SEQUENCER FOR FAST READ
3841 147C' FB AC XRI 0ACH ; DURING ROTATION)
3842 147E' C2 149C' LBZ HDG1B
3843 ; ELSE = TURN ON PWR AT CYC=1B (SEC = x9)
3844 ; READ XYZ AT CYC=1C AND TURN OFF PWR
3845 ; SET XYZ FLG = 00
3846 ;
3847 1481' F8 00 LDI 00 ;Force HDG Flag = 00
3848 1483' 57 STR GPAGE
3849 1484' F8 18 LDN SEC1 ;Run Slow only on Sec =9
3850 1486' A7 PLO GPAGE
3851 1487' 07 LDN GPAGE
3852 1488' FB 09 XRI 09H
3853 148A' CA 14A1' LBNZ HDGXT
3854 ;
3855 148D' F8 19 HDGSLO: LDI CYCLES ;Check cycle
3856 148F' A7 PLO GPAGE
3857 1490' 07 LDN GPAGE
3858 1491' FB 1B XRI 1BH
3859 1493' C2 149C' LBZ HDG1B ; If CYC = 1B go to HDG1B
3860 1496' FB 07 XRI (1BH XOR 1CH)
3861 1498' 32 A4' BZ HDG1C ; If CYC = 1C go to HDG1C
3862 149A' 30 A1' BR HDGXT ; If not 1B or 1C return to LBT
3863 ;
3864 ;

MACRO-18 3.36 PAGE 1-84
SEA DUCT: SD05R9.MAC 16 SEP 86

3865 149C' E1 HDG1B: SEX INTPC ;SET GROUP 02
3866 149D' 61 OUT GROUP
3867 149E' 02 DB 02
3868 149F' 67 OUT RELAYS ;TURN ON HEADING INDICATOR PWR
3869 14A0' 41 DB 101Q
3870 14A1' C0 0888' HDGXT: LBR HDGRTN
3871 ;
3872 ;
3873 14A4' E2 HDG1C: SEX STACK
3874 ; SCAL R6, HDGIN ;READ IN THE HEADING
3875 14A5' 68 86 +
3876 14A7' 14B1' +
3877 ;
3878 14A9' E1 SEX INTPC ;SET GROUP 02
3879 14AA' 61 OUT GROUP
3880 14AB' 02 DB 02
3881 14AC' 67 OUT RELAYS ;TURN OFF HEADING INDICATOR PWR
3882 14AD' 01 DB 01Q
3883 14AE' C0 14A1' LBR HDGXT
3884 ;
3885 ;
3886 ;*** SUBROUTINE - INPUT HEADING ***
3887 ;
3888 ; ** CALLED BY THIS ROUTINE AND EXT. SEQUENCER ROTATION ROUTINE **
3889 ;
3890 14B1' E1 HDGIN:: SEX INTPC
3891 14B2' 61 OUT GROUP
3892 14B3' 01 DB 01
3893 14B4' 63 OUT HLATCH ;LATCH DATA IN ENCODER
3894 14B5' 00 DB 00 ;NULL DATA
3895 ; RLDI RA ,0008H ;SHIFT IN DATA TO I/O BOARD
3896 14B6' 68 CA +
3897 14B8' 0008 +
3898 ;
3899 14BA' 64 HDGAGN: OUT HSHIFT ;SEND SHIFT PULSE
3900 14BB' 00 DB 00
3901 14BC' C4 NOP ;SMALL DELAY
3902 14BD' C4 NOP
3903 14BE' 2A DEC RA
3904 14BF' 8A GLO RA
3905 14C0' 3A BA' BNZ HDGAGN ;ANOTHER SHIFT PULSE?
3906 ;
3907 14C2' F8 85 LDI HDG ;INPUT HEADING
3908 14C4' A7 PLO GPAGE
3909 14C5' B7 SEX GPAGE
3910 14C6' 6C INP HEADNG

MACRO-18 3.36 PAGE 1-85
SEA DUCT: SD05R9.MAC 16 SEP 86

3911 ;
3912 14C7' E2 SEX STACK
3913 ; SRET R6
3914 14C8' 68 96 +
3915 ;
3916 ;
3917 ;
3918 ;***** RELAY DRIVER PULSE ROUTINE *****
3919 ;
3920 14CA' F8 40 PULCHK: LDI PULFLG
3921 14CC' A7 PLO GPAGE
3922 14CD' 07 LDN GPAGE ;Pulse flag = AC
3923 14CE' FB AC XRI OACH
3924 14D0' 3A E8' BNZ PSETOO ;If not, set to 00
3925 14D2' 17 INC GPAGE ; SET GPAGE = PULCNT
3926 14D3' 07 LDN GPAGE
3927 14D4' 32 E8' BZ PSETOO
3928 14D6' FF 01 SMI 01 ;DECREMENT THE PULSE COUNTER
3929 14D8' 57 STR GPAGE ; AND STORE IT
3930 14D9' E1 SEX INTPC
3931 14DA' 61 OUT GROUP ;SET RELAYS GROUP
3932 14DB' 02 DB 02
3933 14DC' 17 INC GPAGE
3934 14DD' 27 SEX GPAGE
3935 14DE' 07 LDN GPAGE
3936 14DF' FA 3F ANI 077Q ;Mask Relay #
3937 14E1' F9 40 ORI 100Q ; Set Relay Data Bit = ON
3938 14E3' 57 STR GPAGE
3939 14E4' 67 OUT RELAYS ; Turn on the Relay driver
3940 14E5' C0 14FD' LBR PULXT ;EXIT THE ROUTINE
3941 ;
3942 14E8' 51 PSETOO: SEX INTPC
3943 14E9' 61 OUT GROUP ;SET RELAYS GROUP
3944 14EA' 02 DB 02
3945 14EB' F8 42 LDI PULNUM
3946 14ED' A7 PLO GPAGE
3947 14EE' E7 SEX GPAGE
3948 14EF' 07 LDN GPAGE
3949 14F0' FA 3F ANI 077Q ;Set Relay Data Bit = OFF
3950 14F2' 57 STR GPAGE
3951 14F3' 67 OUT RELAYS ;Turn Off the Relay Driver
3952 ;
3953 14F4' 27 DEC GPAGE ;SET GPAGE = PULNUM
3954 14F5' F8 FF LDI OFFH
3955 14F7' E7 SEX GPAGE
3956 14F8' 73 STXID ;Set PULNUM = FF (FF IS NOT USED)

MACRO-18 3.36 PAGE 1-86
SEA DUCT: SD05R9.MAC 16 SEP 86

3957 14F9' F8 00 LDI 00
3958 14FB' 73 STXD ;Set PULCNT = 00
3959 14FC' 57 STR GPAGE ;Set PULFLG = 00
3960 14FD' C0 088B' PULXT: LBR PULRTN ;EXIT THE ROUTINE
3961 ;
3962 ;
3963 ;***** READ XYZ POSITION *****
3964 ; ENTERS FROM LONG BRANCH TABLE
3965 ;
3966 1500' F8 B4 XYZCHK: LDI XYZFLG ;CHECK XYZ FLAG STATUS
3967 1502' A7 PLO GPAGE ; AC = TURN ON OPTO INTERRUPTER PWR
3968 1503' 07 LDN GPAGE ; (USED BY SEQUENCER FOR FAST READ
3969 1504' FB AC XRI 0A8H ; DURING XYZ POSITIONING)
3970 1506' C2 1525' LBZ XYZON ; ELSE = TURN ON PWR AT CYC=24 (SEC = x9)
3971 ; ; READ XYZ AT CYC=25 AND TURN OFF PWR
3972 ; ; SET XYZ FLG = 00
3973 ; ; ****!!! NOTE:
3974 ; ; **** CYCLE 25 CURRENTLY MUST LEAVE PWR ON
3975 ; ; DUE TO HDWR. BUG *****
3976 ;
3977 1509' F8 00 LDI 00 ;FORCE XYZFLG = 00
3978 150B' 57 STR GPAGE
3979 150C' F8 18 LDI SEC1 ;CHECK FOR SEC = x9
3980 150E' A7 PLO GPAGE
3981 150F' 07 LDN GPAGE
3982 1510' FB 09 XRI 09H
3983 1512' CA 1522' LBNZ XYZXT ;IF NOT = x9, EXIT
3984 1515' F8 19 LDI CYCLES
3985 1517' A7 PLO GPAGE
3986 1518' 07 LDN GPAGE
3987 1519' FB 24 XRI 24H
3988 151B' C2 1525' LBZ XYZON
3989 151E' FB 01 XRI (24H XOR 25H)
3990 1520' 32 2C' BZ XYZIN
3991 1522' C0 088E' XYZXT: LBR XYZRTN
3992 ;
3993 1525' B1 XYZON: SEX INTPC
3994 1526' 61 OUT GROUP
3995 1527' 02 DB J2
3996 1528' 67 OUT RELAYS
3997 1529' 4C DB 114Q ;TURN ON OPTO INTERRUPTER PWR
3998 152A' 30 22' BR XYZXT
3999 ;
4000 152C' B1 XYZIN: SEX INTPC
4001 152D' 61 OUT GROUP
4002 152E' 00 DB 00

MACRO-18 3.36
SEA DUCT: SD05R9.MAC 16 SEP 86

PAGE 1-87

4003	152F'	E7	SEX GPAGE
4004	1530'	F8 93	LDI XPOS
4005	1532'	A7	PLO GPAGE
4006	1533'	68	INP X :INPUT X POSITION
4007	1534'	FA 0F	ANI OFH :MASK UNUSED BITS
4008	1536'	57	STR GPAGE
4009	1537'	17	INC GPAGE :GPAGE => YX POSITION
4010	1538'	6C	INP YZ
4011			:
4012	1539'	E1	SEX INTPC
4013	153A'	61	OUT GROUP
4014	153B'	02	DB 02
4015	153C'	67	OUT RELAYS
4016	153D'	4C	DB 114Q :TURN OFF OPTO INTERRUPTER PWR
4017			:*** NOTE !!! PWR IS KEPT ON -- DUE TO HDWR. BUG ***
4018	153E'	30 22'	BR XYZXT
4019			:
4020			:
4021			:
4022			:***** PASS THRU MODE *****
4023			:
4024			:
4025	1540'	F8 0A	PTHRU: LDI GRPSAV :PWR UP LOOP 2
4026	1542'	A7	PGC GPAGE
4027	1543'	F8 02	LDI 02 : STORE NEW I/O GROUP
4028	1545'	57	STR GPAGE
4029	1546'	E7	SEX GPAGE
4030	1547'	61	OUT GROUP
4031	1548'	E3	SEX PC
4032	1549'	67	OUT RELAYS :POWER UP LOOP2
4033	154A'	40	DB 100Q
4034	154B'	27	DEC GPAGE
4035	154C'	F8 06	LDI UARTS
4036	154D'	57	STR GPAGE
4037	154E'	E7	SEX GPAGE
4038	1550'	61	OUT GROUP :RESET UART I/O GROUP
4039			:
4040	1551'	F8 02	LDI PLEVEL :SET PASS LEVEL = 01
4041	1553'	A7	PLO GPAGE
4042	1554'	F8 01	LDI 01
4043	1556'	57	STR GPAGE
4044			:
4045	1557'	E2	SEX STACK
4046			SCAL R6, DELAY2 :WAIT FOR LOOP 2 POWER TO SETTLE
4047	1558'	68 86	+
4048	155A'	019B'	+

MACRO-18 3.36 PAGE 1-88
SEA DUCT: SD05R9.MAC 16 SEP 86

4049 SCAL R6, DELAY2 ; AND UARTS TO CLEAR BREAK
4050 155C' 68 86 +
4051 155E' 019B' +
4052 SCAL R6, DELAY2
4053 1560' 68 86 +
4054 1562' 019B' +
4055 ;
4056 1564' E2 RADDR2: SEX STACK :CLEAR ANY DATA FROM LOOP 2
4057 1565' 6C INP DATA2
4058 1566' F8 FE LDI IOLOC :XMIT '*' ON LOOP 2
4059 1568' A7 PLO GPAGE
4060 1569' F8 23 LDI '*'
4061 156B' 57 STR GPAGE
4062 SCAL R6, XMTLP2
4063 156C' 68 86 +
4064 156E' 167D' +
4065 1570' E2 DA1: SEX STACK
4066 1571' 6B INP STAT1 :CHECK FOR DA1
4067 1572' F6 SHR :DA1?
4068 1573' 3B 93' BNF DA2 :IF NOT GO TO DA2
4069 1575' FA 06 ANI 06H :IF DA1, MASK AND CHECK P.E.06
4070 1577' 32 7C' BZ KEEP3
4071 1579' 6A INP DATA1 :CLEAR BAD DATA
4072 157A' 30 93' BR DA2
4073 ;
4074 157C' F8 FE KEEP3: LDI IOLOC
4075 157E' A7 PLO GPAGE
4076 157F' E7 SEX GPAGE
4077 1580' 6A INP DATA1
4078 1581' FA 7F ANI 7FH :MASK MSB
4079 1583' 57 STR GPAGE
4080 1584' FB 23 XRI '*' :IS IT '*'?
4081 1586' C2 00AB' LBZ IOERR
4082 1599' FB 06 XRI ('*' XOR '*') :IS IT '*'?
4083 1583' C2 160A' LBZ PMODE
4084 158E' E8 PMODEX: SEX STACK
4085 SCAL R6, XMTLP2
4086 158F' 68 86 +
4087 1591' 167D' +
4088 ;
4089 ;
4090 1593' 6D DA2: INP STAT2
4091 1594' F6 SHR :DA2?
4092 1595' C3 1588' LBDF DA2YES :IF NOT, CHECK ES LOOP 2
4093 1598' FB 08 XRI 08H :IF ES LOOP 2,
4094 159A' C2 163B' LBZ PASSBR ; GO TO PASS BREAK

MACRO-18 3.36 PAGE 1-89
 SEA DUCT: SD05R9.MAC 16 SEP 36

```

4095 159D' 30 70'           BR DA1      ;IF NOT GO TO DA1
4096                           ;
4097 159F' 6D               DA2MOR: INP STAT2
4098 15A0' F6               SHR          ;DA2?
4099 15A1' C3 1598'          LBDF DA2YES   ;IF NOT, CHECK ES LOOP 2
4100 15A4' FB 08             XRI 08H     ;IF ES LOOP 2,
4101 15A6' C2 163E'          LBZ PASSBR   ;      GO TO PASS BREAK
4102 15A9' 1C               INC RC      ;IF NOT, INC TIME OUT LOOP
4103 15AA' 9C               GHI RC
4104 15AB' FB 02             XRI 02      ;IF NOT 512 LOOPS (2 CHAR),
4105 15AD' CA 159F'          LBNZ DA2MOR   ;LOOK FOR MORE DATA ON 2
4106 15B0' S2               SEX STACK
4107                           SCAL R6, TSRE? ;IF 512, WAIT FOR TSRE AND
4108 15B1' 68 86             +
4109 15B3' 02F0'             +
4110 15B5' C0 1570'          LBR DA1      ;      GO TO DA1
4111                           ;
4112 15B8' FA 06             DA2YES: ANI 06H   ;MASK FOR PE, PE
4113 15BA' CA 163E'          LBNZ PASSBR  ;IF PE OR PE, GO TO PASS BREAK
4114 15BD' F8 00             LDI 00
4115 15BF' 3C               PHI RC
4116 15C0' AC               PLO RC
4117 15C1' F8 FE             LDI IOLOC   ;IF DATA IS OK, INPUT DATA
4118 15C3' A7               PLO GPAGE   ;      ON LOOP 2      TO I/O LOCATION
4119 15C4' 37               SEX GPAGE
4120 15C5' 6C               INP DATA2
4121 15C6' FA 7F             ANI 7FH     ;MASK MSB
4122 15C8' 57               STR GPAGE
4123 15C9' F3 03             XRI 03      ;IS IT ETX ?
4124 15CB' C2 15E2'          LBZ PMT2    ;IF ETX, ADD A PROMPT
4125                           ;
4126 15C3' E2               NOTETX: SEX STACK ;IF DATA LOOP 2 IS NOT ETX:
4127 15CF' 6B               INP STAT1   ;CHECK PE, PE ON LOOP 1
4128 15D0' FA 0C             ANI 0CH
4129 15D2' CA 0GAB'          LBZ IOERR   ;BRANCH IF ERROR
4130 15D5' 02               LDN STACK
4131 15D6' FE               SHL          ;WAIT FOR THRE LOOP 1
4132 15D7' C8 15CE'          LBNE NOTETX
4133 15DA' E7               SEX GPAGE
4134 15DB' 62               OUT DATA1   ;IN LOOP 2 -> OUT LOOP 1
4135 15DC' 27               DBC GPAGE
4136 15DD' FC 00             ADI 00      ;CLEAR DF
4137 15DF' C0 159F'          LBR DA2MOR   ;GO TO DA2MOR
4138                           ;
4139 15E2' E2               PMT2: SEX STACK ;IF DATA LOOP 2 = ETX:
4140 15E3' 6B               INP STAT1   ;CHECK PE, PE ON LOOP 1
  
```

MACRO-18 3.36 PAGE 1-90
SEA DUCT: SD05R9.MAC 16 SEP 86

4141	15E4'	FA OC	ANI OCH	
4142	15E6'	CA 00AB'	LBNZ IOERR	;BRANCH IF ERROR
4143	15E9'	02	LDN STACK	
4144	15EA'	FE	SHL	;WAIT FOR THRE LOOP 1
4145	15EB'	3B E2'	BNF PMT2	
4146	15ED'	E3	SEX PC	
4147	15EE'	62	OUT DATA1	;OUTPUT PROMPT CHAR. ON LOOP 1
4148	15EF'	3A	DB PMTCHR	
4149	15F0'	FC 00	ADI 00H	;CLEAR DF
4150	15F2'	E2	SEX STACK	
4151	15F3'	63	XMTETX: INP STAT1	;CHECK FE, PE ON LOOP 1
4152	15F4'	FA OC	ANI OCH	
4153	15F6'	CA 00AB'	LBNZ IOERR	;BRANCH IF ERROR
4154	15F9'	02	LDN STACK	
4155	15FA'	FE	SHL	;WAIT FOR THRE LOOP 1
4156	15FB'	3B F3'	BNF XMTETX	
4157	15FD'	E7	SEX GPAGE	
4158	15FE'	62	OUT DATA1	;IN LOOP 2 -> OUT LOOP 1
4159	15FF'	27	DEC GPAGE	
4160	1600'	FC 00	ADI 00	;CLEAR DF
4161	1602'	E2	SEX STACK	
4162			SCAL R6, TSRE?	;WAIT-TSRE1 AND CLEAR ECHO 1
4163	1603'	68 86		
4164	1605'	02F0'		
4165	1607'	CO 1570'	LBR DA1	;GO TO DA1
4166				;
4167				;
4168				;
4169	160A'	E2	PMODE: SEX STACK	
4170			SCAL R6, ITS	;PMODE ENTERED WHEN LOOP 1 = '%'
4171	160B'	68 86		
4172	160D'	022E'		
4173	160F'	50	DB 'P'	
4174	1610'	161F'	DW PINC	;OPEN THE NEXT LOWER LEVEL
4175	1612'	52	DB 'R'	
4176	1613'	1564'	DW RADDR2	;READDRESS THE CURRENT LEVEL
4177	1615'	42	DB 'B'	
4178	1616'	163E'	DW PASSBR	;SEND BREAK ON LOOP 2
4179	1618'	58	DB 'X'	
4180	1619'	1658'	DW PDEC	;DROP THE LOWEST LEVEL
4181	161A'	FF	DB DONE	
4182	161C'	CO 158E'	LBR PMODEX	
4183				;
4184				;
4185	161F'	F8 02	PINC: LDI PLEVEL	;INCREMENT PASS LEVEL
4186	1621'	A7	PLO GPAGE	

MACRO-13 3.36 PAGE 1-91
SEA DUCT: SD05R9.MAC 16 SEP 86

4187	1622'	07	LDN GPAGE
4188	1623'	FC 01	ADI 01H
4189	1625'	57	STR GPAGE
4190	1626'	F8 FE	LDI IOLOC
4191	1628'	A7	PLO GPAGE
4192	1629'	F8 25	LDI 'Y'
4193	162B'	57	STR GPAGE
4194	162C'	E2	SEX STACK
4195			SCAL R6, XNTLP2
4196	162D'	68 86	+
4197	162F'	167D'	+
4198	1631'	F8 FE	LDI IOLOC
4199	1633'	A7	PLO GPAGE
4200	1634'	F8 50	LDI 'P'
4201	1636'	57	STR GPAGE
4202			SCAL R6, XNTLP2
4203	1637'	68 36	+
4204	1639'	167D'	+
4205	163B'	CO 1593'	LBR DA2
4206			;
4207			;
4208	163E'	F8 02	PASSBR: LDI PLEVEL ;CLEAR PASS LEVEL
4209	1640'	A7	PLO GPAGE
4210	1641'	F8 00	LDI 00
4211	1643'	57	STR GPAGE
4212			SEX STACK ;
4213			SCAL R6, XMTBR2 ;BREAK LOOP 2 (NOT USED WITH LOOP2
4214			; PWR CONTROL SYSTEM)
4215	1644'	F8 0A	LDI GRPSAV
4216	1646'	A7	PLO GPAGE
4217	1647'	F8 02	LDI 02
4218	1649'	57	STR GPAGE
4219	164A'	E7	SEX GPAGE
4220	164B'	61	OUT GROUP
4221	164C'	B3	SEX PC
4222	164D'	67	OUT RELAYS ;LOOP2 POWER OFF
4223	164E'	00	DB 00
4224	164F'	27	DEC GPAGE ;RESET UART GROUP
4225	1650'	B7	SEX GPAGE
4226	1651'	F8 06	LDI UARTS
4227	1653'	57	STR GPAGE
4228	1654'	61	OUT GROUP
4229	1655'	CO 0107'	LBR PROMPT ;EXIT PASS THRU MODE TO PROMPT
4230			;
4231			;
4232	1658'	F8 02	PDEC: LDI PLEVEL

MACRO-18 3.36 PAGE 1-92
SEA DUCT: SD05R9.MAC 16 SEP 86

4233	165A'	A7	PLO GPAGE
4234	165B'	07	LDN GPAGE
4235	165C'	FB 01	XRI 01 ;IS P LEVEL 01 ?
4236	165E'	C0 163B'	LBR PASSBR ; IF SO, BREAK LOOP 2
4237	1661'	07	LDN GPAGE
4238	1662'	FF 01	SMI 01 ; IF NOT, DECREMENT PASS LEVEL
4239	1664'	57	STR GPAGE
4240	1665'	F8 FE	LDI IOLOC
4241	1667'	A7	PLO GPAGE
4242	1668'	F8 25	LDI '4' ;OUTPUT \$ ON LOOP 2
4243	166A'	57	STR GPAGE
4244	166B'	E2	SEX STACK
4245			SCAL R6, XMTLP2
4246	166C'	68 86	+
4247	166E'	167D'	+
4248	1670'	F8 FE	LDI IOLOC
4249	1672'	A7	PLO GPAGE ;OUTPUT X ON LOOP 2
4250	1673'	F8 58	LDI 'X'
4251	1675'	57	STR GPAGE
4252			SCAL R6, XMTLP2
4253	1676'	68 86	+
4254	1678'	167D'	+
4255	167A'	C0 1593'	LBR DA2 ;GO TO DA2
4256			;
4257			;
4258			;***** XMIT LOOP 2 *****
4259			;
4260	167D'	F8 FE	XMTLP2: LDI IOLOC
4261	167F'	A7	PLO GPAGE
4262	1680'	E7	SEX GPAGE
4263	1681'	F0	LDX
4264	1682'	AA	PLO RA ;ALSO PUT IT IN RA
4265	1683'	64	OUT DATA2 ;OUTPUT CHARACTER LOOP 2
4266	1684'	27	DEC GPAGE
4267	1685'	E2	SEX STACK
4268	1686'	6C	INP DATA2 ;CLEAR DA
4269	1687'	6D	WAIT6: INP STAT2
4270	1688'	FA C0	ANI 0COH ;MASK FOR THRE & TSRE
4271	168A'	FB C0	XRI 0COH
4272	168C'	3A 87'	BNZ WAIT6
4273			SCAL R6, DELAY2 ;2 BIT DELAY
4274	168E'	68 86	+
4275	1690'	0198'	+
4276	1692'	E7	SEX GPAGE
4277	1693'	6C	INP DATA2 ;INPUT ECHOED CHAR
4278	1694'	FA 7F	ANI 07FH ;MASK MSB

MACRO-18 3.36 PAGE 1-93
SEA DUCT: SD05R9.MAC 16 SEP 86

4279 1696' 57 STR GPAGE
4280 1697' 8A GLO RA ;COMPARE WITH XMIT CHAR
4281 1698' F3 XOR
4282 1699' CA 163E' LBNZ PASSBR ;BREAK IF ECHO WAS BAD
4283 169C' E2 SEX STACK
4284 SRRET R6
4285 169D' 68 96 +
4286 ;
4287 ;
4288 ;
4289 ;***** XMITBR2 *****
4290 ;(BREAK LOOP 2)
4291 ;
4292 169F' F8 0A XMTBR2: LDI GRPSAV ;SELECT UART I/O GROUP
4293 16A1' A7 PLO GPAGE ; AND STORE ON GLOBAL PAGE
4294 16A2' F8 06 LDI UARTS
4295 16A4' 57 STR GPAGE
4296 16A5' E7 SEX GPAGE
4297 16A6' 61 OUT GROUP
4298 16A7' E3 SEX PC
4299 16A8' 65 OUT CNTRL2 ;BREAK LOOP 2
4300 16A9' 52 DB (40H OR FORMT1)
4301 16AA' F8 7D LDI BR2CNT
4302 16AC' A7 PLO GPAGE
4303 16AD' F8 0A LDI 0AH ;0A = 250 uS2C. (10 INTERRUPT CYCLES)
4304 16AF' 57 STR GPAGE
4305 16B0' E2 SEX STACK
4306 SRRET R6
4307 16B1' 68 96 +
4308 ;
4309 ;
4310 ;
4311 ;*****
4312 ORG (HELP + 700H)
4313 ; MUX AND A/D CONTROL
4314 ;
4315 1700' 0000 MUXLST: DW 0000H ;CYCLE 00 A/D OFF MUX PITCH
4316 1702' 0000 DW 0000H ;CYCLE 01
4317 1704' 0000 DW 0000H ;CYCLE 02
4318 1706' 0000 DW 0000H ;CYCLE 03
4319 1708' 0000 DW 0000H ;CYCLE 04
4320 170A' 0000 DW 0000H ;CYCLE 05
4321 170C' 0000 DW 0000H ;CYCLE 06
4322 170E' 0202 DW 0202H ;CYCLE 07 A/D ON MUX PITCH
4323 1710' 0302 DW 0302H ;CYCLE 08 A/D START PULSE,MUX PITCH
4324 1712' 1212 DW 1212H ;CYCLE 09 A/D ON MUX ROLL

MACRO-18 3.36 PAGE 1-94
SEA DUCT: SD05R9.MAC 16 SEP 86

4325	1714'	1312	DW 1312H	;CYCLE 0A	A/D START PULSE,MUX ROLL
4326	1716'	2222	DW 2222H	;CYCLE 0B	A/D ON MUX UP BAT
4327	1718'	2322	DW 2322H	;CYCLE 0C	A/D START PULSE MUX UP BAT
4328	171A'	3232	DW 3232H	;CYCLE 0D	A/D ON MUX SYSBAT
4329	171C'	3332	DW 3332H	;CYCLE 0E	A/D START PULSE MUX SYSBAT
4330	171E'	4242	DW 4242H	;CYCLE 0F	A/D ON MUX A/D GND
4331	1720'	4342	DW 4342H	;CYCLE 10	A/D START PLUSE MUX A/D GND
4332	1722'	5252	DW 5252H	;CYCLE 11	A/D ON MUX A/D REF
4333	1724'	5352	DW 5352H	;CYCLE 12	A/D START PULSE MUX A/D REF
4334	1726'	6262	DW 6262H	;CYCLE 13	A/D ON MUX A/D +5V
4335	1728'	6362	DW 6362H	;CYCLE 14	A/D START PULSE MUX A/D +5V
4336	172A'	7070	DW 7070H	;CYCLE 15	A/D OFF MUX TRANSMISSOMETER
4337				;	
4338				;	
4339				ORG (HELP + 780H)	
4340				;	A/D STORAGE LOCATIONS
4341				;	
4342	1780'	89	MEMLST: DB PITCH	;	PITCH (PENDULUM 1)
4343	1781'	AF	DB (NULL)	;	
4344	1782'	8A	DB ROLL	;	ROLL (PENDULUM 2)
4345	1783'	AF	DB (NULL)	;	
4346	1784'	8B	DB BATTUP	;	UP BATTERY
4347	1785'	AF	DB (NULL)	;	
4348	1786'	8C	DB BATTSY	;	SYS BATTERY
4349	1787'	AF	DB (NULL)	;	
4350	1788'	8D	DB ADGH8	;	GND HI 8 BITS
4351	1789'	8E	DB ADGL4	;	GND LOW 4 BITS
4352	178A'	8F	DB ADRH8	;	REF HI 8 BITS
4353	178B'	90	DB ADRL4	;	REF LOW 4 BITS
4354	178C'	91	DB AD5H8	;	+5V HI 8 BITS
4355	178D'	92	DB AD5L4	;	+5V LOW 4 BITS
4356				;	
4357				;	
4358				*****	*****
4359				;	
4360				;	
4361				;	
4362				;	
4363				;	
4364				END	

MACRO-18 3.36 PAGE S
SEA DUCT: SD05R9.MAC 16 SEP 86

MACROS:

BCI	BXI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSMB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRT	XID	XIB

SYMBOLS:

ACSTAT	0081	ACSTR	146A'	ACUCLR	1456'	AD	133F'
AD5H8	0091	AD5L4	0092	ADDR	00DE'	ADDR?	00D1'
ADFLG	0080	ADGH8	008D	ADGL4	008E	ADGO	1367'
ADH18	0003	ADL04	0002	ADRH8	008F	ADRL4	0090
ADRTN	087F'	ADTOH8	00A7	ADTOL4	00A8	ADT1H8	0095
ADT1L4	0096	ADT2H8	0097	ADT2L4	0098	ADT3H8	0099
ADT3L4	009A	ADT4H8	0098	ADT4L4	009C	ADT5H8	009D
ADT5L4	009E	ADT6H8	009F	ADT6L4	00A0	ADT7H8	00A1
ADT7L4	00A2	ADT8H8	00A3	ADT8L4	00A4	ADT9H8	00A5
ADT9L4	00A6	AGAIN	0063'	AR1	001C	AR10	001B
ARI00	001A	ARFLG	001D	ASCHEX	01C8'	ASCRD1	025E'
ASTK	000E	ASTKH1	0064	ASTKLO	0065	ASTKTP	527F
ATCHK	08B1'	ATPLG	001E	ATMFLG	001F	ATRTN	0867'
BANGGR	014F'	BAT1	0002	BAT2	0003	BAT3	0004
BATTSY	008C	BATTUP	008B	BLT	0000	BORROW	0912'
BRIST	011A'	BR2	0A7D'	BR2CLR	0A8D'	BR2CNT	007D
BR2RTN	0873'	BRCHK	089D'	BROKE	08A8'	BUF9	0020
BUFFER	5B00	BUFPG	005B	CANCNT	0088	CAMERA	0006
CKX1	0CAD'	CKX10	098D'	CLOOP1	04CA'	CLR	0548'
CLRAR	0924'	CLRBUF	0542'	CLRPLG	0340'	CLRPB	006C'
CMPARE	0C9C'	CMPASS	0002	CMPPWR	1312'	CMPRTN	0879'
CMPSRD	12F0'	CMPSS	0084	CNTCLR	0C47'	CNTRL1	0003
CNTRL2	0005	CNTRL3	0007	CNVRT	01B0'	COPY	0588'
CRC	04A2'	CRCH1	0006	CRCLO	0007	CRCRAM	0005
CRCSUB	050E'	CTA	0BA0'	CTACLR	0D45'	CTAH1	006C
CTAL0	006D	CTASET	0D4E'	CTAVHI	006B	CTAVLO	006F
CTAX	033A'	CTB	0BB0'	CTBCLR	0D62'	CTBHI	0070
CTBLO	0071	CTBSET	0D6B'	CTBVHI	0072	CTBVLO	0073
CTBX	0D57'	CTC	0BCD'	CTCCLR	0D7F'	CTCH1	0074
CTCHK	0AA0'	CTCLO	0075	CTCSET	0D88'	CTCVHI	0076
CTCVLO	0077	CTCX	0D74'	CTNCRK	0A86'	CTNCLR	0DA3'
CTNUDEC	0AC1'	CTNRTN	0AE2'	CTNSET	0D91'	CTNSTR	0ADE'
CTRCHK	0A97'	CTRRTN	0876'	CYCCNT	0008	CYCLES	0019
CYX001	0A14'	CYXX01	0A06'	CYXXNM	0A22'	CYXXX1	09FA'
D1	0012	D10	0D11	D100	0010	DA1	1570'
DA2	1593'	DA2MOR	159F'	DA2YES	1588'	DATA1	0002
DATA2	0004	DATA3	0006	DAYCAR	09A5'	DAYUP	099C'
DECAR	0907'	DECCTN	03C9'	DECNEX	090C'	DECPPC	0B17I'
DELAY2	0198'	DLY20	0031'	DMA	0000	DOLIM	047D'
DONE	00F7	ENABLE	0771'	ERROR	0080	ERROR1	0429'
ETX	0003	EXP?	12DC'	EXPRUM	000F	EXPSET	12B9'

MACRO-18 3.36 PAGE S-1
 SEA DUCT: SD05R9.MAC 16 SEP 86

FLAGA	0069	FLAGB	006A	FLAGC	006B	FLAGCK	0C10'
FORMT1	0012	GLOPG	0050	GOSUB	0B60'	GOTNUM	00CF'
GP	5000	GPAGE	0007	GROUP	0001	GRPSAV	000A
GTR9	02E4'	H1	0014	H10	0013	HALT	0006
HDG	0085	HDG1B	149C'	HDG1C	14A4'	HDG?	129D'
HDGAGN	14BA'	HDGCHK	1478'	HDGEXP	00BF	HDGFLG	00B3
HDGIN	14B1I'	HDGPWR	0005	BDGRTN	0888'	HDGSET	1273'
HDGSLO	148D'	HDGVAL	0020	BDGXLT	14A1'	HDSTRT	0000'
HEADNG	0004	HELP	1000'	HEXRDI	026C'	HLATCH	0003
HOURUP	097D'	HSHIFT	0004	HXCONV	02D4'	HZ	0028
IDLLOC	0700'	IN1ST	0406'	IN2ND	0416'	IN4D	01A9'
IN4DT?	02E9'	IN4DXT	013A'	INADDR	03FE'	INC10	095B'
INCHAR	0181'	INCMIN	0966'	INCPCC	0B13I'	INCRTC	092D'
INIT	0B4C'	INITB	0C32'	INITC	0C3F'	INITS	0C37'
INITX	0C22'	INKWD	0208'	INLF	0467'	INPUT	0556'
INTCRL	F840	INTIME	05AC'	INTMSK	F800	INTPC	0001
INTPG	00F8	INTPGM	0800'	INTPOL	F840	INTRPO	083F'
INTSTA	F800	INTVEC	F880	IOA	0006	IOCLR	0004
IOCTEL	0005	IOERR	00AB'	IOLOC	00FE	IOSTAT	0005
ITB	022E'	JMPexc	0B66'	JUMP	0B28I'	KEEP1	056C'
KEEP2	018C'	KEEP3	157C'	KEEPT	05B7'	L2BUF	00C0
LBT	0864'	LDVRST	0005	LIST	0006	LNEEND	03EC'
LNTEST	03E3'	LOCK	0331'	LOCKUP	033D'	LOOP2	0BD0'
LOOP2X	0CB9'	LP20TH	0CFF'	LP21ST	0D11'	LP2ERR	0D26'
LP2NTH	0CE4'	LP2OFF	0CC9'	LP2ON	0CD1'	LP2XIT	0D2D'
LP2XMT	0CD9'	M1	0016	M10	0015	MATCH	021E'
MATCH2	0245'	MATCH3	0C88'	MATCH?	0219'	MDONE	07EF'
MEMCHG	0738'	MEMLST	1780'	MEMORY	0007	MEMPTR	00AE
MEMSAV	0734'	MEMSUB	07B2'	MODFLG	032D'	MUX	0C02
MULSLT	1700'	MUXPTR	00AD	NEXBYT	03C2'	NEXT1	01AD'
NEXT2	0234'	NEXT3	0251'	NEXTPG	07C1'	NOBRRW	0914'
NOLOCK	0324'	NOMTCH	0CA7'	NOOP	0BC4'	NOTETX	15CE'
NOTHEX	01EB'	NOYRTN	0392'	NULL	00AF	NUMBER	01E3'
OKRTN	038E'	OPEN	0358'	OPEN?	0348'	OUTADR	03AF'
OUTASC	02CF'	OUTCA	0295'	OUTCHR	0300'	OUTHEX	0271'
OUTPT1	02D1'	OUTPT2	0262'	PASSBR	163E'	PASSCA	045E'
PASSGR	0171'	PC	0003	PCSAME	0E60'	PDCKA	143B'
PDCLR	144D'	PDEC	1658'	PDRTN	0885'	PDSTAT	0083
PDSTR	145F'	PINC	1617'	PING	0007	PITCH	0089
PLEVEL	0002	PLIST	020F'	PMODE	160A'	PMODEX	158E'
PMPSPD	0006	PMT2	15E2'	PMTCHR	003A	POP	0B40'
POP1	0844'	PORTB	0007	POUND?	00C8'	PPC	000C
PPCCMP	0727'	PPCCNT	0068	PPCHI	0060	PPCLO	0061
PPCSHO	0704'	PROMPT	0107'	PSETOO	14E8'	PTECT	0779'
PTHRU	1540'	PULCHK	14CA'	PULCNT	0041	PULFLG	0040
PULNUM	0042	PULRTN	088B'	PULXT	14FD'	PUMP1	0086

MACRO-18 3.36

PAGE S-2

SEA DUCT: SD05R9.MAC 16 SEP 86

PUMP2	0087	PUSH	0B30'	PUSH00	0C77'	PUSH1	0B34'
QUEBUF	1178'	QUESGR	0133'	QUESTM	0396'	QUESTT	05C2'
RADDR2	1564'	RBKI	0008	RBLO	0009	RBRET	085D'
RBSAVE	0894'	READDR	0087'	RECFLG	00B2'	RELAYS	0007
REPORT	0713'	RESTR0	0818'	RESTRT	003F'	RETURN	0B58'
REV	0039	ROLL	008A	RPLY	00BC'	RSTK	000D
RSTKHI	0062	RSTKLO	0063	RSTKTP	523F	RTC	0900'
RTCRTN	086A'	RTNPTR	0006	RTTY2	000F	SAVE	0B14I'
SAVPPC	0C00I'	SAYCLR	04F5'	SAYNO	035D'	SD	0DAD'
SDLNGT	0029	SDREC	0EF3'	SDREQ	0003	SDRET	0891'
SEC1	0018	SEC10	0017	SEMI?	0449'	SEQ01	09EE'
SEQ?	0684'	SEQ?EX	068E'	SEQCYC	09CA'	SEQFAS	0066
SEQNCR	0800'	SEQRAT	0067	SEQRST	0073'	SEQRTN	086D'
SEQSET	0602'	SEQXT1	03E0'	SET2ND	067B'	SETAC	0C1C'
SETAT	094F'	SETCLR	0C14I'	SETFLG	0327'	SETPC	0632'
SETPG	077D'	SETPC	0622'	SETQ	0722'	SETSL	0019'
SETSTK	001E'	SETTOP	0554'	SETUP	005A'	SETURT	0048'
SHPTD4	018F'	SHIFT	01F4'	SSTKPG	0052	STACK	0002
START1	0025'	START2	05A6'	STAT1	0003	STAT2	0005
STAT3	0007	STKCLR	0C59'	STK2ND	53DF	STKERR	0C98'
STRPG	0053	STORE	02DD'	SWITCH	0002	SWPWR	1337'
SWRD	131A'	SWRTN	087C'	SWSTAT	0082	SYSFLG	0003
SYSTEM	0007	TEST	023C'	TESTS	0472'	TEST0	0919'
TEST5	0944'	TEST80	025A'	TEST81	0268'	TEST8D	0288'
TEST9D	0292'	TESTA1	0281'	TESTA2	02C1'	TESTCA	0291'
TESTCR	0454'	TESTDD	02A8'	TESTOK	036F'	TESTSP	0437'
TESTY	0380'	THRE?	0306'	TIME01	003C	TIME02	00F0
TIMEIN	0582'	TIMEJM	057B'	TIMEST	0535'	TLEVEL	005A
TLIMIT	0006	TR	13BA'	TRCY02	13EF'	TRCY17	13FF'
TRCY18	140A'	TRCY19	1413'	TRFLG	00B1	TRRTN	0882'
TSRE?	02F0'	TST2ND	09C1'	TSTADV	0984'	TSTMEX	091C'
TTY	024E'	TTY2	0A32'	TTY2HI	007E	TTY2LO	007F
TY2ETX	0A5C'	TY2OUT	0A47'	TY2RTN	0870'	UARTS	0006
UNADDR	00B4'	UNLOCK	0315'	VERS	0035	WAIT	0034'
WAIT1	05CE'	WAIT2	05F7'	WAIT3	019D'	WAIT4	02F1'
WAIT6	1687'	WRITEM	03F5'	WTFOR	0B80'	WTFORX	0C6F'
WTILL	0B70'	X	0003	XMTBR2	169F'	XMTETX	15F3'
XMTLP2	167D'	XPOS	0093	XYZCHK	1500'	XYZFLG	0084
XYZIN	152C'	XYZON	1525'	XYZRTN	088E'	XYZXT	1522'
YZ	0004	YZPOS	0094				

NO FATAL ERROR(S)

ASTITP	59\$	204	207	2483
ATCHK	1809	1861\$		
ATFLG	59\$	1929		
ATMFLG	59\$			
ATRTN	1810\$	1865	1874	
BANGGR	362	402\$		
BAT1	59\$			
BAT2	59\$			
BAT3	59\$			
BATTSY	59\$	4348		
BATTUP	59\$	4346		
BCI	42\$			
BLT	59\$			
BORROW	1894\$			
BR1ST	350	356\$		
BR2	1814	2140\$		
BR2CLR	2149\$			
BR2CNT	59\$	2140	4301	
BR2RTN	1815\$	2144	2148	2156
BRCHK	1843\$			
BROKE	1849	1852\$		
BUF9	59\$	1222		
BUFFER	59\$	2792	3302	
BUFFPG	59\$	59	176	1634
BXI	42\$			
CALL	42\$			
CAMCNT	59\$			
CAMERA	59\$			
CHK1	2543	2549\$		
CHK10	1974\$			
CID	42\$			
CIE	42\$			
CLOOP1	1128\$	1138	1140	
CLR	1225\$	1232		
CLRAR	1906\$	2012		
CLRBUF	1218	1220\$		
CLRFLG	829\$			
CLRPGB	182	184\$		
CMPARE	2342	2511	2535\$	
CMPASS	59\$	3531	3537	
CMPPWV	3521	3534\$		
CMPRTN	1818\$	3517	3523	3532
CMPSRD	1817	3512\$		
CMPSS	59\$	3528		
CNTCLR	2444	2455	2461\$	
CNTRL1	59\$	150		
CNTRL2	59\$	153	2152	4299
CNTRL3	59\$			
CNVRT	491	496\$		

COPY	1269	1272\$
CRC	384	1101\$
CRCHI	59\$	
CRCLO	59\$	1121
CRCRAM	59\$	
CRCSUB	1135	1169\$
CTA	2352\$	
CTACLR	2672	2677\$
CTAHI	59\$	2173
CTALO	59\$	2465
CTASET	2674	2684\$
CTAVHI	59\$	2174
CTAVLO	59\$	
CTAX	2352	2670\$
CTB	2356\$	
CTBCLR	2696	2701\$
CTBHII	59\$	2179
CTBL0	59\$	2469
CTBSET	2698	2708\$
CTBVHI	59\$	2180
CTBVLO	59\$	
CTBX	2356	2694\$
CTC	2360\$	
CTCCLR	2720	2725\$
CTCHI	59\$	2185
CTCHK	2169\$	
CTCL0	59\$	2473
CTCSET	2722	2732\$
CTCVHI	59\$	2186
CTCVLO	59\$	
CTCX	2360	2718\$
CTNCHK	2172	2178
CTNCLR	2464	2468
CTNDEC	2197	2201\$
CTNRRTN	2199	2223
CTNSET	2687	2711
CTNSTR	2203	2205
CTRCHK	1815	2163\$
CTRRTN	1817\$	2167
CYCCNT	59\$	1888
CYCLES	59\$	1911
	3647	3719
		3778
		3855
		3984
CYX001	2036	2062\$
CYXX01	2034	2038
CYXXNN	2026	2070\$
CYXXX1	2032	2047\$
D1	59\$	
D10	59\$	2337
D100	59\$	

DA1	4065\$	4095	4110	4165							
DA2	4068	4072	4090\$	4205	4255						
DA2NOR	4097\$	4105	4137								
DA2YES	4092	4099	4112\$								
DACI	42\$										
DADC	42\$										
DADD	42\$										
DADI	42\$										
DATA1	59\$	450	455	761	769	786	1305	1310	1869	4071	4077
	4147	4158									4134
DATA2	59\$	2106	2108	2126	2154	4057	4120	4265	4268	4277	
DATA3	59\$										
DAYCAR	1992\$	2001									
DAYUP	1973	1985\$									
DBNZ	42\$										
DECAR	1887\$	2015									
DECCTNT	942	945\$									
DECNEZ	1890\$	1898									
DECPPC	2266\$										
DELAY2	311	460	466\$	768	858	922	1015	1313	4048	4051	4054
DLY20	124\$										4275
DNA	59\$	2791	2810	2811	2819	2820	2829	2830	2838	2839	2847
	2854	2855	2857	2858	2866	2867	2870	2871	2874	2875	2878
	2882	2883	2885	2887	2890	2891	2894	2895	2898	2899	2902
	2906	2907	2910	2911	2914	2915	2918	2922	2923	2929	2936
	2943	2948	2949	2954	2955	2961	2965	2966	2968	2969	2974
	2981	2988	2989	2995	2999	3000	3003	3004	3010	3017	3018
	3028	3029	3032	3033	3039	3046	3047	3053	3057	3058	3063
	3070	3077	3078	3084	3088	3089	3092	3093	3099	3106	3107
	3117	3124									3110
DOLIN	1068\$										
DONE	59\$	295	329	346	371	395	423	439	687	302	324
	880	935	1020	1080	1120	1154	1165	1217	1323	1345	1413
	1444	1472	1487	1528	1565	1577	1608	3275	3423	3442	3467
	3505	4181									3483
DSAV	42\$										
DSBI	42\$										
DSM	42\$										
DSMB	42\$										
DSMI	42\$										
DTC	42\$										
ZENABLE	1576	1580\$									
ERROR	59\$	2622	2649	2863							
ERROR1	1005	1013\$	1039								
ETQ	42\$										
ETX	59\$	345	879	1107	1118	1398	1432	1564	1595	1604	
EXIT	42\$										
EXP?	394	3494\$									
EXPNUM	59\$	2801	3485	3494							

EXPSET	422	3473\$										
FLAGA	59\$											
FLAGB	59\$											
FLAGC	59\$											
FLAGCK	2407\$											
FORMATI	59\$	151	154	2153	4300							
GEC	42\$											
GLOPG	59\$	59	140	171	185	1642	1729					
GOSUB	2318\$											
GOTNUM	278	284\$										
GP	59\$											
J2AGE	59\$	131	133	141	144	146	147	172	191	193	194	196
	197	199	200	202	203	205	206	208	227	229	249	250
	259	260	265	304	305	307	453	454	457	487	506	509
	512	515	518	521	523	547	572	599	627	638	660	667
	710	720	728	731	734	736	783	785	787	809	310	312
	831	832	888	977	978	991	997	1022	1046	1052	1063	1064
	1122	1125	1126	1127	1143	1145	1169	1172	1173	1179	1187	1220
	1240	1243	1264	1273	1274	1275	1280	1283	1285	1289	1308	1309
	1312	1325	1326	1328	1331	1351	1352	1378	1383	1384	1386	1450
	1474	1475	1477	1520	1631	1633	1634	1676	1678	1679	1730	1732
	1733	1738	1793	1800	1801	1803	1835	1837	1838	1840	1862	1863
	1871	1873	1884	1885	1890	1891	1895	1901	1907	1909	1912	1913
	1915	1919	1921	1923	1926	1930	1931	1934	1936	1937	1939	1944
	1946	1950	1952	1954	1959	1961	1966	1971	1974	1975	1980	1982
	1986	1987	1989	1992	1994	2004	2305	2009	2014	2021	2022	2023
	2041	2042	2048	2049	2055	2056	2063	2064	2070	2074	2075	2085
	2086	2088	2091	2109	2131	2141	2142	2145	2147	2164	2165	2192
	2193	2206	2210	2214	2215	2219	2225	2245	2246	2248	2250	2252
	2254	2256	2338	2391	2392	2404	2419	2426	2446	2487	2503	2518
	2535	2545	2549	2588	2589	2595	2596	2614	2623	2624	2626	2631
	2635	2637	2638	2640	2650	2651	2653	2661	2663	2744	2747	2748
	2750	2751	2753	2754	2756	2766	2767	2782	2783	2785	2786	2802
	2803	2812	2821	2831	2840	2852	2864	2921	2924	2930	2938	2945
	2953	2956	2962	2967	2973	2976	2982	2990	2996	3002	3005	3011
	3019	3025	3031	3034	3040	3048	3054	3062	3065	3071	3079	3085
	3091	3094	3100	3108	3114	3126	3127	3131	3290	3292	3296	3297
	3445	3447	3455	3486	3488	3496	3513	3514	3518	3519	3529	3530
	3548	3549	3559	3560	3584	3585	3589	3590	3595	3597	3598	3609
	3613	3614	3617	3619	3620	3622	3624	3625	3636	3637	3645	3648
	3649	3653	3659	3660	3663	3664	3668	3672	3674	3683	3684	3689
	3690	3695	3696	3705	3707	3710	3711	3714	3720	3721	3750	3751
	3756	3759	3763	3779	3780	3785	3786	3794	3796	3802	3804	3811
	3814	3816	3824	3827	3829	3839	3840	3848	3850	3851	3856	3857
	3908	3909	3921	3922	3925	3926	3929	3933	3934	3935	3938	3946
	3947	3948	3950	3953	3955	3959	3967	3968	3978	3980	3981	3985
	3986	4003	4005	4008	4009	4026	4028	4029	4034	4036	4037	4041
	4043	4059	4061	4075	4076	4079	4118	4119	4122	4133	4135	4157
	4159	4186	4187	4189	4191	4193	4199	4201	4209	4211	4216	4218

LP2NTH	2594\$								
LP2OFF	2566	2573\$							
LP2ON	2568	2580\$							
LP2XIT	2571	2602	2656\$						
LP2XNT	2570	2587\$							
M1	59\$								
M10	59\$								
MATCH	576\$								
MATCH2	608	612\$							
MATCH3	2512	2513\$							
MATCH?	562	572\$							
MDONE	1639	1675\$							
MEMCHG	1616	1630\$							
MEMLST	3621	4342\$							
MEMORY	59\$	1665							
MEMPTR	59\$	3658	3671						
MEMSAV	368	1551\$							
MEMSUB	114	1623\$							
NODFLG	812\$	834							
MUX	59\$	3642	3643	3734	3742	3744	3770		
MUXLST	3618	3639	4315\$						
MUXPTR	59\$	3616	3635						
NEXBYT	941\$	954	959						
NEXT1	484\$	499	503						
NEXT2	600\$	611							
NEXT3	628\$	644	671	688	695	714	724		
NEXTPG	1638\$	1673							
NOBRRW	1893	1895\$							
NOLOCK	803	805\$							
NOMTCH	2544\$	2552							
NOOP	2364\$								
NOTETX	4126\$	4132							
NOTEX	508	514	517	527\$					
NOVRTN	890	894\$							
NULL	59\$	4343	4345	4347	4349				
NUMBER	511	521\$							
OKRTN	891\$								
OPEN	846	848\$							
OPEN?	410	840\$							
OUTADR	923\$	971							
OUTASC	717	726\$							
OUTCA	583\$								
OUTCHR	643	739	777\$	782					
OUTEX	653\$	679							
OUTPT1	701	728\$							
OUTPT2	641\$	729							
PASSBR	436	438	4094	4101	4113	4178	4208\$	4236	4232
PASSCA	1029	1035	1043\$	1048					
PASSGR	370	430\$							

SCM2	42#												
SD	1828	2781#											
SDLNGT	59#	3138											
SDREC	3129	3134#											
SDREQ	59#	3137											
SDRET	1829#	2784	2788	3132	3139								
SEC1	59#	1324	2781	3289	3512	3583	3688	3784	3849	3979			
SEC10	59#												
SEMI?	1026	1031#											
SEQ01	2023	2040#	2079										
SEQ?	388	1450#											
SEQ?EX	1479#	1488											
SEQCYC	1811	2020#											
SEQFAS	59#												
SEQNCR	2030	2044	2051	2059	2067	2078	2244#	2274	2279	2292	2303	2307	
	2317	2333	2347	2351	2355	2359	2363	2367	2371	2376	2384		
SEQRAT	59#	2020											
SEQRST	186	190#											
SEQRTN	1813#	2045	2052	2060	2068	2413							
SEQSET	416	1361#	1445										
SEQXT1	2377#												
SET2ND	1417	1437	1440#										
SETAC	2422	2425#											
SETAT	1933#												
SETCLR	2419#												
SETFLG	307#	850											
SETPC	1372	1392#											
SETPG	1584	1588#											
SETPPC	1377#	1423											
SETQ	1643	1647	1651	1655	1659	1661	1664#						
SETSL	86	99#											
SETSTK	104#	1856											
SETTOP	1233#	1255											
SETUP	121	171#											
SETURT	143#												
SHFTD4	502	532#	1008										
SHIFT	536#	544											
SPM1	42#												
SPM2	42#												
SRET	42#	236	474	492	525	528	552	569	588	604	619	632	
	740	770	790	892	895	1055	1095	1206	1682	2231	2474	2493	
	2547	2556	2758	2772	3913	4284	4306						
SSTXPG	59#	59	59	1646	2478								
STACK	59#	105	107	111	235	244	277	279	290	308	336	473	
	533	545	551	558	568	582	585	587	595	603	613	616	
	618	649	653	654	655	664	665	677	760	780	789	806	
	807	828	829	849	855	870	881	915	916	918	923	936	
	937	939	1085	1132	1205	1223	1230	1233	1235	1239	1253	1262	
	1267	1270	1281	1522	1681	1735	1736	1767	1769	1833	1846	1883	

Y2POS 59#

```
1 ; I1806A.MAC - Macro Definitions for RCA 1805A/6A Opcodes
2 ;
3 ;
4 ; 20 FEB 1986
5 ; W. E. TERRY
6 ;
7 ; (LISTING SUPRESSED)
8 ;
9 ; With some Level II codes
10 ;
11 .XLIST ;TURN OFF LISTING
12 .SALL ;INHIBIT SOURCE LISTING
13 ;
14 ;
15 ;*****-
16 ;
17 ; For use with Syscon M18 assembler -- adds:
18 ; 1805A/6A capability
19 ; some RCA LEVEL II CODES
20 ; some WET MACROS
21 ;
22 ; Include this file into source program using
23 ; INCLUDE I1806A.MAC
24 ;
25 ;
26 ;*****-
27 ;
28 ;
29 ;----- COUNTER CONTROL -----
30 ;
31 ;
32 STPC MACRO ;STOP COUNTER
33 DB 68H,00H
34 ENDM
35 ;
36 DTC MACRO ;DECREMENT COUNTER
37 DB 68H,01H
38 ENDM
39 ;
40 SPM2 MACRO ;SET PULSE MODE 2
41 DB 68H,02H
42 ENDM
43 ;
44 SPM1 MACRO ;SET PULSE MODE 1
45 DB 68H,04H
46 ENDM
```

```
47      ;  
48          SCM2 MACRO      :SET COUNTER MODE 2  
49          DB 68H,03H  
50          ENDM  
51      ;  
52          SCM1 MACRO      :SET COUNTER MODE 1  
53          DB 68H,05H  
54          ENDM  
55      ;  
56          LDC MACRO       :LOAD COUNTER  
57          DB 68H,06H  
58          ENDM  
59      ;  
60          STM MACRO       :SET TIMER MODE  
61          DB 68H,07H  
62          ENDM  
63      ;  
64          GEC MACRO       :GET COUNTER  
65          DB 68H,08H  
66          ENDM  
67      ;  
68          ETQ MACRO       :ENABLE TOGGLE Q  
69          DB 68H,09H  
70          ENDM  
71      ;  
72      ;  
73      ;----- REGISTER OPS -----  
74      ;  
75      ;  
76          RNX MACRO P1      :RN TO RX COPY  
77          DB 68H,(0B0H + P1)  
78          ENDM  
79      ;  
80          RLDI MACRO P1,P2    :REGISTER LOAD IMMEDIATE  
81          DB 68H,(0C0H + P1)  
82          DW P2  
83          ENDM  
84      ;  
85      ;  
86      ;----- MEMORY OPS -----  
87      ;  
88      ;  
89          RLXA MACRO P1     :REGISTER LOAD VIA X AND ADVANCE  
90          DB 68H,(060H + P1)  
91          ENDM  
92      ;
```

```
93      RSXD MACRO P1           ;REGISTER STORE VIA X AND DECREMENT
94      DB 68H,(0AOH + P1)
95      ENDM
96      ;
97      ;
98      ;----- BRANCHES -----
99      ;
100     ;
101     BCI MACRO P1           ;BRANCH ON COUNTER INTERRUPT
102     DB 68H,3EH
103     DB LOW (P1)
104     ENDM
105     ;
106     BXI MACRO P1           ;BRANCH ON EXTERNAL INTERRUPT
107     DB 68H,3FH
108     DB P1
109     ENDM
110     ;
111     DBNZ MACRO P1,P2        ;DECREMENT AND BRANCH IF NOT ZERO
112     DB 68H,(020H + P1)
113     DW P2
114     ENDM
115     ;
116     ;
117     ;----- INTERRUPT CONTROL -----
118     ;
119     ;
120     XIE MACRO              ;EXTERNAL INTERRUPT ENABLE
121     DB 68H,0AH
122     ENDM
123     ;
124     XID MACRO              ;EXTERNAL INTERRUPT DISABLE
125     DB 68H,0BH
126     ENDM
127     ;
128     CIE MACRO              ;COUNTER INTERRUPT ENABLE
129     DB 68H,0CH
130     ENDM
131     ;
132     CID MACRO              ;COUNTER INTERRUPT DISABLE
133     DB 68H,0DH
134     ENDM
135     ;
136     DSAV MACRO              ;SAVE D
137     DB 68H,76H
138     ENDM
```

139 ;
140 ;
141 ;
142 ;----- BCD ARITHMETIC -----
143 ;
144 ;
145 ;
146 DADC MACRO ;ADD WITH CARRY
147 DB 68H,74H
148 ENDM
149 ;
150 DSMB MACRO ;SUBTRACT MEMORY WITH BORROW
151 DB 68H,77H
152 ENDM
153 ;
154 DACI MACRO P1 ;ADD WITH CARRY, IMMEDIATE
155 DB 68H,7CH
156 DB P1
157 ENDM
158 ;
159 DSBI MACRO P1 ;SUBTRACT MEMORY WITH BORROW, IMMEDIATE
160 DB 68H,7FH
161 DB P1
162 ENDM
163 ;
164 DADD MACRO ;ADDITION
165 DB 68H,0F4H
166 ENDM
167 ;
168 DSM MACRO ;SUBTRACT MEMORY
169 DB 68H,0F7H
170 ENDM
171 ;
172 DADI MACRO P1 ;ADD IMMEDIATE
173 DB 68H,0FC8H
174 DB P1
175 ENDM
176 ;
177 DSMI MACRO P1
178 DB 68H,0FFH
179 DB P1
180 ENDM
181 ;
182 ;----- SUBROUTINE CONTROL -----
183 ;
184 ;

```
185      ;  
186          SCAL MACRO P1,P2      ;RCA SCAL  
187          DB 68H,(80H + P1)  
188          DW P2  
189          ENDM  
190      ;  
191          SRET MACRO P1      ;RCA SRET  
192          DB 68H,(90H + P1)  
193          ENDM  
194      ;  
195          TCAL MACRO P1      ;TERRY SCAL USING  
196          SEX STACK           ;X=R2=STACK  
197          DB 68H,86H           ;RN=R6=RTNPTR  
198          DW P1  
199          ENDM  
200      ;  
201          TRET MACRO      ;TERRY SRET USING:  
202          SEX STACK           ;X=R2=STACK  
203          DB 68H,96H           ;RN=R6=RTNPTR  
204          ENDM  
205      ;  
206      ;----- RCA LEVEL II MACROS -----  
207      ;  
208          CALL MACRO P1  
209          SEP R4  
210          DW P1  
211          ENDM  
212      ;  
213          EXIT MACRO  
214          SEP R5  
215          ENDM  
216      ;  
217          PUSH MACRO  
218          STXD  
219          ENDM  
220      ;  
221          POP MACRO  
222          LDXA  
223          ENDM  
224      ;  
225          IDLE MACRO  
226          IDL  
227          ENDM  
228      ;  
229          PPAGE MACRO  
230          ORG HDSTRT+(S-LOW($))+100H
```

MACRO-18 J.36

PAGE

1-5

231
232
233
234

ENDM

.LIST

MACRO-18 3.36

PAGE

S

MACROS:

BCI	BXI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSMB	DSMI	DTC
STQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRET	XID	XIE

SYMBOLS:

NO FATAL ERROR(S)

BCI	101\$
BXI	106\$
CALL	208\$
CID	132\$
CIE	128\$
DACI	154\$
DADC	146\$
DADD	164\$
DADI	172\$
DBNZ	111\$
DSAV	136\$
DSBI	159\$
DSM	168\$
DSMB	150\$
DSMI	177\$
DTC	36\$
ETQ	68\$
EXIT	213\$
GBC	64\$
IDLE	225\$
LDC	56\$
POP	221\$
PPAGE	229\$
PUSH	217\$
RLDI	80\$
RLXA	89\$
RNX	76\$
RSXD	93\$
SCAL	186\$
SCM1	52\$
SCM2	48\$
SPM1	44\$
SPM2	40\$
SRET	191\$
STM	60\$
STPC	32\$
TCAL	195\$
TRET	201\$
XID	124\$
XIZ	120\$

1 : SEA DUCT EQUATE TABLE - ISDEQU.MAC
2 :
3 : 26 AUG 86 - SD05R9
4 :
5 : W. E. TERRY
6 :
7 : INCLUDING:
8 : REGISTER ALLOCATION
9 : GLOBAL PAGE REFERENCES
10 : I/O EQUATES
11 : DEFAULT VALUES
12 :
13 : (LISTING SUPRESSED)
14 : .XLIST
15 :
16 : PREVIOUS VERSION: 08 AUG 86 - SD05R6
17 : PREVIOUS VERSION: 20 JUN 86 - SD05R5
18 : PREVIOUS VERSION: 21 MAR 86 - SD05R2 thru 5R4
19 :
20 :
21 :***** THIS FILE MUST BE INCLUDED IN ALL
22 : SEA DUCT PROGRAM SOURCE (*.MAC) FILES
23 :
24 : USE "INCLUDE ISDEQU.MAC"
25 :
26 :***** THIS FILE MUST NOT BE INCLUDED IN SEA DUCT SEQUENCER
27 : MACRO PROGRAM SOURCE (*.MAC) FILES
28 :
29 :
30 :
31 :
32 :***** REGISTER ALLOCATION *****
33 :
34 :***** SAIL REGISTERS *****
35 :
36 : 0000 DMA EQU R0 :DMA IN/OUT - ALSO START
37 : 0001 INTPC EQU R1 :INTERRUPT PROGRAM COUNTER
38 : 0002 STACK EQU R2 :UTILITY STACK
39 : 0003 PC EQU R3 :MAIN PROGRAM COUNTER
40 : : R4 :SCRT CALL * SCRT NOT USED BY *
41 : : R5 :SCRT RETURN * THIS PROGRAM *
42 : 0006 RTN PTR EQU R6 :POINTER FOR RETURN & IMMEDIATE BYTES
43 : 0006 LIST EQU R6 : * * * *
44 : 0007 GPAGE EQU R7 :GLOBAL PAGE S & R R7.0 :R7.1 REMAINS CONSTANT
45 : 0008 CYCCNT EQU R8 :REAL TIME CLOCK CYCLE COUNT, OTHER MISC.
46 :

```
47      :**** NOTE: S & R => SAVED AND RESTORED BY INTERRUPT ****
48      :          FOR USE OUTSIDE INTERRUPT
49      :
50      :          REGISTERS A - F, 7.0 ARE S & R
51      :
52      :
53      :***** INTERRUPT REGISTERS *****
54      :
55      :          INTERRUPT PC = R1
56      :
57      000C    PPC    EQU RC :SEQUENCER PSEUDO PROGRAM COUNTER
58      000D    RSTK   EQU RD :SEQUENCER RETURN STACK
59      000E    ASTK   EQU RE :SEQUENCER STACK
60      :
61      000F    RTTY2  EQU RF :TTY2 OUTPUT POINTER
62      :
63      :**** REGISTER B IS ALSO SAVED AND RESTORED
64      :          FROM INSIDE INTERRUPT TO INTERRUPT
65      :
66      :
67      :***** MISC. ALLOCATION *****
68      :
69      :Q      UT4 (BLT.2):INTERRUPT PULSE:MEM. PROTECT
70      :SP1   INTERRUPT      ( FUTURE OPTION )
71      :SP2
72      :EF3   SEA DATA RECORDER
73      :EF4   UT4 (BLT.2)
74      :
75      :
76      :***** I/O SELECT *****
77      :
78      0001    GROUP  EQU 01 :SELECT = OUT 01; READ = INP 01 - GROUP SELECT
79      :
80      :
81      :***** GROUP 0 *****
82      :
83      :< INPUT >
84      :
85      0002    SWITCH EQU 02 :BOTTOM AND INSERTION SWITCHES
86      0003    X       EQU 03 :X POSITION
87      0004    YZ      EQU 04 :YX POSITIONS
88      :PING   EQU 07 :ACOUSTIC TRANSPONDER
89      :
90      :< OUTPUT >
91      :
92      0002    BAT1   EQU 02 :BATTERY 1 RELAY
```

```
93    0003      BAT2 EQU 03 :BATTERY 2 RELAY
94    0004      BAT3 EQU 04 :BATTERY 3 RELAY
95    0005      LDVRST EQU 05 :RESET THE LDV
96    0006      CAMERA EQU 06 :TAKE A PICTURE
97    0007      PING EQU 07 :PINGER
98
99
100   :
101   :
102   :< INPUT >
103   :
104   0002      CMPPASS EQU 02 :INPUT COMPASS
105   0004      HEADING EQU 04 :INPUT HEADING
106   :
107   :< OUTPUT >
108   :
109   :CMPPASS EQU 02 :COMPASS PWR. AND LATCH
110   0003      BLATCH EQU 03 :LATCH HEADING
111   0004      HSHIFT EQU 04 :HEADING SER. SHIFT IN
112   0005      HDGPWR EQU 05 :HEADING POWER
113   :
114   :
115   :***** GROUP 2 *****
116   :
117   :< INPUT >
118   :
119   0002      ADL04 EQU 02 :A/D    FOUR LSB's
120   0003      ADH18 EQU 03 :A/D    EIGHT MSB's
121   0007      RELAYS EQU 07 :RELAY CONTROLS
122   :
123   :< OUTPUT >
124   :
125   0002      MUX EQU 02 :MUX AND A/D CONTROL
126   0003      SDREQ EQU 03 :SEA DATA RECORD REQUEST
127   0006      PMPSPD EQU 06 :CIRCULATION PUMP SPEED
128   :RELAYS EQU 07 :RELAY SENSE LINES
129   :
130   :
131   :***** GROUP 3 *****
132   :
133   :
134   :***** GROUP 4 *****
135   :
136   :*** GROUP 5 - 1851 BIT I/O ***
137   :
138   :< INPUT >
```

```
139      :
140 0005    IOSTAT EQU 05 :1851 PORT STATUS
141          :IOA = 06 :READ PORT A
142          :IOB = 07 :READ PORT B
143          :
144          :< OUTPUT >
145          :
146 0004    IOCLR EQU 04 :CLEAR 1851
147 0005    IOCTEL EQU 05 :1851 PORT CONTROL
148 0006    IOA EQU 06 :LOAD PORT A
149 0007    PGRTB EQU 07 :LOAD PORT B
150          :
151          :
152          :***** GROUP 6 - UARTS *****
153          :
154 0006    UARTS EQU 06 :UART GROUP
155 0012    FORMT1 EQU 12H :7 DATA BITS, 1 STOP BIT, EVEN PARITY
156          :
157          :< INPUT >
158          :
159 0002    DATA1 EQU 02 :LEVEL 1 SAIL UART
160 0003    STAT1 EQU 03 :LEVEL 1 SAIL UART
161 0004    DATA2 EQU 04 :LEVEL 2 SAIL UART
162 0005    STAT2 EQU 05 :LEVEL 2 SAIL UART
163 0006    DATA3 EQU 06 :NOT USED
164 0007    STAT3 EQU 07 :NOT USED
165          :
166          :< OUTPUT >
167          :
168 0003    CNTRL1 EQU 03 :LEVEL 01 SAIL UART CONTROL
169 0005    CNTRL2 EQU 05 :LEVEL 02 SAIL UART CONTROL
170 0007    CNTRL3 EQU 07 :NOT USED
171          :
172          :
173          :***** GROUP 7 *****
174          :
175 0007    SYSTEM EQU 07
176          :
177          :< INPUT >
178          :
179          :< OUTPUT >
180          :
181 0006    HALT EQU 06 :SUICIDE FUNCTION
182 0007    MEMORY EQU 07 :MEMORY PAGE PROTECT OR ENABLE
183          :
184          :
```

185 :***** DEFINITIONS AND REFERENCES *****
186 :
187 :
188 :*** SAIL PROM LOCATIONS (2716'S) AND PAGE REFERENCES ***
189 :
190 0000 BLT EQU 00H :*** BLT MONITOR PROM BASE PAGE ***
191 0050 GLOPG EQU 050H :*** GLOBAL PAGE
192 0052 SSTKPG EQU 052H :*** SEQUENCER STACK PAGE ***
193 0053 STKPG EQU 053H :*** MAIN STACK BASE PAGE ***
194 005B BUFPG EQU 05BH :*** SEA DATA OUTPUT BUFFER PAGE ***
195 00F8 INTPG EQU 0F8H :*** INTERRUPT CONTROLLER BASE PAGE
196 : : (CDP1877) ***
197 :
198 : : BLT.2 MONITOR RAM PAGE = 5700:STACK END = 57DF
199 :
200 :
201 :*** OTHER REFERENCES ***
202 :
203 :
204 53DF STKEND EQU (STKPG * 100H) + 0DFH :*** MAIN STACK END = STKPG+DF
205 :
206 523F RSTKTP EQU (SSTKPG * 100H) + 3FH :SEQ R STACK TOP - RSTK = 5200 - 523F
207 527F ASTKTP EQU (SSTKPG * 100H) + 7FH :SEQ A STACK TOP - ASTK = 5240 - 527F
208 :
209 F800 INTMSK EQU (INTPG * 100H) + 00H :INTERRUPT MASK - WRITE ONLY
210 F840 INTCTRL EQU (INTPG * 100H) + 40H :INTERRUPT CONTROL - WRITE ONLY
211 F880 INTVEC EQU (INTPG * 100H) + 80H :INTERRUPT PAGE REGISTER - WRITE ONLY
212 F800 INTSTA EQU (INTPG * 100H) + 00H :INTERRUPT STATUS REG. - READ ONLY
213 F840 INTPOL EQU (INTPG * 100H) + 40H :INTERRUPT POLLING REG. - READ ONLY
214 :
215 5B00 BUFFER EQU (BUFPG * 100H) :SEADATA BUFFER 0 LOCATION
216 :
217 :
218 :
219 :***** GLOBAL PAGE REFERENCES *****
220 :
221 5000 GP EQU (GLOPG * 100H)
222 :
223 0002 PLEVEL EQU 02H :PASS THRU LEVEL
224 0003 SYSFLG EQU 03H :SYSTEM FLAG :ADDR:WRITE:SYS: : : : : : :
225 0005 CRCRAM EQU 05H :CRC CALC. SCRATCH
226 0006 CRCHI EQU 06H :CRC HI BYTE RESULT
227 0007 CRCLO EQU 07H :CRC LO BYTE RESULT
228 0008 RBHI EQU 08H :RB.1 SAVE FROM LAST INTERRUPT
229 0009 RBLO EQU 09H :RB.0 SAVE FROM LAST INTERRUPT
230 000A GRPSAV EQU 0AH :CURRENT I/O GROUP (OUTSIDE INTERRUPT)

231 :
232 000F :EXPNUM EQU 0FH :EXPERIMENT NUMBER (LOW NIBBLE ONLY)
233 :
234 00F8 :IOLOC EQU 0FH :I/O BYTE
235 :
236 :
237 :***** REAL TIME CLOCK LOCATIONS *****
238 :
239 0028 H2 EQU 40 :40 Hz INTERRUPT RATE
240 :
241 0010 D100 EQU 10H :DAYS X 100
242 0011 D10 EQU 11H :DAYS X 10
243 0012 D1 EQU 12H :DAYS X 1
244 0013 H10 EQU 13H :HOURS X 10
245 0014 H1 EQU 14H :HOURS X 1
246 0015 M10 EQU 15H :MIN. X 10
247 0016 M1 EQU 16H :MIN. X 1
248 0017 SEC10 EQU 17H :SEC. X 10
249 0018 SEC1 EQU 18H :SEC. X 1
250 0019 CYCLES EQU 19H :RTC CYCLE COUNT
251 001A AR100 EQU 1AH :ADV.-RET. CNT X 100
252 001B AR10 EQU 1BH :ADV.-RET. CNT X 10
253 001C AR1 EQU 1CH :ADV.-RET. CNT X 1
254 001D ATPLG EQU 1DH :00= RETARD, 01= NORM., 02= ADVANCE: RTC REF. LOC.
255 001E ATPLG EQU 1EH :# FLAG
256 001F ATMFLG EQU 1FH :# MINUTE FLAG
257 0020 BUF9 EQU 20H :START OF 9 DIGIT INPUT BUFFER
258 :
259 :
260 :***** INSTRUMENT SPECIFIC FLAGS *****
261 :
262 0040 PULFLG EQU 40H :RELAY DRIVER PULSE FLAG (AC = ON)
263 0041 PULCNT EQU 41H :RELAY DRIVER PULSE COUNTER (00=DONE)
264 0042 PULNUM EQU 42H :RELAY DRIVER NUMBER (= FF when inactive)
265 :
266 :
267 :***** SEQUENCER *****
268 :
269 0060 PPCHI EQU 60H :SEQ PSUEDO PC HI BYTE POINTER
270 0061 PPCLO EQU 61H :" " PC LO BYTE POINTER
271 0062 RSTKHI EQU 62H :SEQ R STACK LO BYTE POINTER
272 0063 RSTKLO EQU 63H :SEQ R STACK HI BYTE POINTER
273 0064 ASTKHI EQU 64H :SEQ A STACK LO BYTE POINTER
274 0065 ASTKLO EQU 65H :SEQ A STACK HI BYTE POINTER
275 :
276 :

```

277 0066      SEQFAS EQU 66H      :SEQ CTR FOR FAST CYCLE MODE
278 0067      SEQRAT EQU 67H      :SEQ CYCLE RATE FOR INDIV. SEQ. INST.
279          :          ; if SEQRAT MSB=1 (ie. 8x), check lo nibble:
280          :          ; (1000 0000) EVERY CYCLE
281          :          ; (1000 0001) EVERY OTHER CYCLE
282          :          ; (1000 0010) EVERY FOURTH CYCLE
283          :          ; (1000 0100) EVERY EIGHT CYCLE
284          :          ; if MSB = 0 (ie. 0x) run on cycle #NN and #01
285          :          ; if SEQRAT = 00, run only on cycle #01
286          :
287          :
288 0068      PPCCNT EQU 68H      :# TIMES THRU CURRENT PPC
289          :
290 0069      FLAGA EQU 69H      :FLAG A LOCATION
291 006A      FLAGB EQU 6AH      :FLAG B LOC.
292 006B      FLAGC EQU 6BH      :FLAG C LOC.
293          :
294          :
295 006C      CTACHI EQU 6CH      :COUNTER A, HI CNT.
296 006D      CTALO EQU 6DH      :COUNTER A, LO CNT.
297 006E      CTAVHI EQU 6EH      :COUNTER A, HI VECTOR
298 006F      CTAVLO EQU 6FH      :COUNTER A, LO VECTOR
299          :
300 0070      CTBHI EQU 70H      :COUNTER B, HI CNT.
301 0071      CTBLO EQU 71H      :COUNTER B, LO CNT.
302 0072      CTBVHI EQU 72H      :COUNTER B, HI VECTOR
303 0073      CTBVLO EQU 73H      :COUNTER B, LO VECTOR
304          :
305 0074      CTCHI EQU 74H      :COUNTER C, HI CNT.
306 0075      CTCLO EQU 75H      :COUNTER C, LO CNT.
307 0076      CTCVHI EQU 76H      :COUNTER C, HI VECTOR
308 0077      CTCVLO EQU 77H      :COUNTER C, LO VECTOR
309          :
310          :
311          :***** PASS THRU LOOP FLAGS *****
312          :
313 007D      BR2CNT EQU 7DH      :COUNTER FOR BREAK LOOP 2
314 007E      TTY2HI EQU 7EH      :TTY2 OUTPUT LIST POINTER
315 007F      TTY2LO EQU 7FH      :"
316          :
317          :
318          :***** INSTRUMENT SPECIFIC *****
319          :
320 0080      ERROR EQU 80H      :ERROR WORD :XYZ;ROT;TLT; -- ; -- , -- ;L2TI;L2UR;
321 0081      ACSTAT EQU 81H      :XPNDER STATUS :Signal.to Surface; -- ;Cmd3;Cmd2;Cmd1;
322 0082      SWSTAT EQU 82H      :SWITCH STATUS :Bot; - ; - ;Ins0;Ins4;Ins3;Ins2;Ins1;

```

323	0083	PDSTAT	EQU 83H	:RELAY POD STATUS
324		:		
325	0084	CMPSS	EQU 84H	:COMPASS VALUE
326	0085	HDG	EQU 85H	:HEADING VALUE
327	0086	PUMP1	EQU 86H	:FLUME PUMP 1 SPEED
328	0087	PUMP2	EQU 87H	:FLUME PUMP 2 SPEED
329		:		
330	0088	CAMCNT	EQU 88H	:CAMERA FRAME COUNTER
331	0089	PITCH	EQU 89H	:PITCH - PENDULUM 1 (OLD TILT1)
332	008A	ROLL	EQU 8AH	:ROLL - PENDULUM 2 (OLD TILT2)
333	008B	BATTUP	EQU 8BH	:UP BATTERY VOLTAGE * (1/6)
334		:		
335	008C	BATTSY	EQU 8CH	:SYS BATTERY VOLTAGE * (1/6)
336	008D	ADGR8	EQU 8DH	:A/D GROUND VALUE HI 8 BITS
337	008E	ADGL4	EQU 8EH	:A/D GROUND VALUE LO 4 BITS
338	008F	ADR8	EQU 8FH	:A/D REFERENCE VALUE HI 8 BITS
339		:		
340	0090	ADRL4	EQU 90H	:A/D REFERENCE VALUE LO 4 BITS
341	0091	AD5H8	EQU 91H	:A/D +5V VALUE HI 8 BITS
342	0092	AD5L4	EQU 92H	:A/D +5 VALUE LO 4 BITS
343	0093	XPOS	EQU 93H	:CARRAGE X POSITION
344		:		
345	0094	YZPOS	EQU 94H	:CARRAGE Y,Z POSITION
346	0095	ADT1H8	EQU 95H	:1st SEC. TRANSMISSOMETER HI 8 BITS (BA98:7654)
347	0096	ADT1L4	EQU 96H	:1st SEC. TRANSMISSOMETER LO 4 BITS (FFFF:3210)
348	0097	ADT2H8	EQU 97H	:2nd SEC. TRANS HI 8 BITS (BA98:7654)
349		:		
350	0098	ADT2L4	EQU 98H	:2nd SEC. TRANS LO 4 BITS (FFFF:3210)
351	0099	ADT3H8	EQU 99H	:3rd SEC. TRANS HI 8 BITS
352	009A	ADT3L4	EQU 9AH	:3rd SEC. TRANS LO 4 BITS
353	009B	ADT4H8	EQU 9BH	:4th SEC. TRANS HI 8 BITS
354		:		
355	009C	ADT4L4	EQU 9CH	:4th SEC. TRANS LO 4 BITS
356	009D	ADT5H8	EQU 9DH	:5th SEC. TRANS HI 8 BITS
357	009E	ADT5L4	EQU 9EH	:5th SEC. TRANS LO 4 BITS
358	009F	ADT6H8	EQU 9FH	:6th SEC. TRANS HI 8 BITS
359		:		
360	00A0	ADT6L4	EQU 9AH	:6th SEC. TRANS LO 4 BITS
361	00A1	ADT7H8	EQU 9AH	:7th SEC. TRANS HI 8 BITS
362	00A2	ADT7L4	EQU 9AH	:7th SEC. TRANS LO 4 BITS
363	00A3	ADT8H8	EQU 9AH	:8th SEC. TRANS HI 8 BITS
364		:		
365	00A4	ADT8L4	EQU 9AH	:8th SEC. TRANS LO 4 BITS
366	00A5	ADT9H8	EQU 9AH	:9th SEC. TRANS HI 8 BITS
367	00A6	ADT9L4	EQU 9AH	:9th SEC. TRANS LO 4 BITS
368	00A7	ADT0H8	EQU 9AH	:10th SEC. TRANS HI 8 BITS (BA98:7654)

369 00A8 ADTOL4 EQU 0A8H ;10THSEC. TRANS LO 4 BITS (FFFF)3210
370 :
371 :
372 00AD MUXPTR EQU 0ADH ;MUX LIST POINTER FOR A/D
373 00AE MEMPTR EQU 0AEH ;MEM LIST POINTER FOR A/D
374 00AF NULL EQU 0A9H ;NULL STROAGE LOC. FOR UNUSED
375 : ;A/D LO4 BITS
376 :
377 :
378 00B0 ADPLG EQU 0B0H ;A/D 'ON' FLAG, AC = ON
379 00B1 TRPLG EQU 0B1H ;TRANSMISSOMETER A/D 'ON' FLAG, AC = ON
380 00B2 RECPLG EQU 0B2H ;SEA DATA RECORDER 'ON' FLAG, AC = ON
381 :
382 00B3 HDGFLG EQU 0B3H ;HEADING (ROTATION) FLAG:
383 : AC = TURN ON ROTATION ENCODER PWR
384 : (USED BY SEQUENCER FOR FAST READ
385 : DURING ROTATION)
386 : ELSE = TURN ON PWR AT CYC=1B (SEC = x9)
387 : READ HEADING AT CYC=1C AND TURN OFF PWR
388 : SET HEADING FLG = 00
389 :
390 00B4 XYZFLG EQU 0B4H ;XYZ POSITIONS FLAG:
391 : AC = TURN ON OPTO INTERRUPTER PWR
392 : (USED BY SEQUENCER FOR FAST READ
393 : DURING XYZ POSITIONING)
394 : ELSE = TURN ON PWR AT CYC=24 (SEC = x9)
395 : READ XYZ AT CYC=25 AND TURN OFF PWR
396 : SET XYZ FLG = 00
397 :
398 00BF HDGEXP EQU 0BFH ;PLUME HEADING VALUE FOR THE EXPXIMENT
399 :
400 00C0 L2BUF EQU 0C0H ;LOOP 2 RECEIVE BUFFER (USED BY TTY2)
401 :
402 :
403 :***** INSTRUMENT SPECIFIC EQUATES *****
404 :
405 003A PMTCRR EQU ':' ;PROMPT CHARACTER = :
406 :
407 0003 ETX EQU 03H ;ASCII ETX = 03
408 00FF DONE EQU 0FFH ;USED BY TTY CALLS
409 :
410 0029 SDLNGT EQU 41D ;SEA DATA RECORD LENGTH (BYTES)
411 :
412 0020 HDGVAL EQU 020H ;PLUME HEADING DEFAULT VALUE
413 : ;NOTE! - WATER FLOWS FROM HDGVAL
414 :

```
415 003C          TIME01 EQU 60D      :TIME OUT CONST. FOR XYZ POSITION MOVEMENT
416 :
417 00F0          TIME02 EQU 0F0H     :TIME OUT CONST. FOR ROTATION MOVEMENT
418 :
419 :
420 :
421 005A          TLEVEL EQU 05AH    :PENDULUM TILT ZERO VALUE
422 0006          TLIMIT EQU 06D     :EXPERIMENT TILT LIMITS (IN DEGREES)
423 :
424 :
425 :2 BIT DELAY ROUTINE
426 :SAIL ADDRESS AND REPLY
427 :DELAY 250      ( 250 nSEC DELAY)
428 :DELAY 20       ( INITIAL SETUP DELAY)
429 :
430 :
431 .LIST
432 :
433 :
```

1 :PAGE 60
2 :
3 : SUBTITLE SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86
4 :
5 : PREVIOUS VERSION: SDE5R7.MAC 20 AUG 86
6 : PREVIOUS VERSION: SDE5R6.MAC 14 AUG 86
7 : PREVIOUS VERSION: SDE5R5.MAC 21 JUN 86
8 :
9 : PREVIOUS VERSIONS EXIST
10 :
11 : W. E. TERRY
12 :
13 : SEA DUCT EXTENDED SEQUENCER FUNCTIONS
14 : (SEQUENCER PREFIX EC)
15 :
16 : INCLUDE I1806A.MAC
17 : I1806A.MAC - Macro Definitions for RCA 1305A, 6A OpCodes
18 :
19 : 20 FEB 1986
20 : W. E. TERRY
21 :
22 : LISTING SUPPRESSED.
23 :
24 : With some Level II codes
25 :
26 : .LIST
27 :
28 : INCLUDE ISDEQU.MAC
29 : SEA DUCT EQUATE TABLE - ISDEQU.MAC
30 :
31 : 26 AUG 86 - SDE5R7
32 :
33 : W. E. TERRY
34 :
35 : INCLUDING:
36 : REGISTER ALLOCATION
37 : GLOBAL PAGE REFERENCES
38 : I/O EQUATES
39 : DEFAULT VALUES
40 :
41 : LISTING SUPPRESSED
42 : .LIST
43 :
44 :
45 :
46 :
47 :

MACRO-16 J.36 PAGE 1-1
SEADUCT EXT SEQUENCER: SDB5R9.MAC 22 SEP 86

```
47          **** : NOTE: . ****
48          ;
49          : ASSEMBLY OF THIS EXTENDED PROGRAM REQUIRES LINKING
50          : THIS PROGRAM SEGMENT WITH THE MAIN SEA DUCT SEGMENT VIA L13.
51          ;
52          : USE: L18 /P:800/D:5000,SDOnRn,/P:2000/D:5000,SDEnRn,SDSYSn/X/X/E
53          :           for generation of ".HEX" file. Use MBASIC HXRCA to get ".RCA" file.
54          ;
55          : USE: L18 /P:800/D:5000,SDOnRn,/P:2000/D:5000,SDEnRn,SDSYSn/N/E
56          :           for generation of ".COM" file. Use BURN to burn the PROMS.
57          ;
58          ;*****
59          ;
60          EXTRN DECPPC, INCPPC, JUMP, SAVPPC, SETCLR
61          EXTRN HDGIN
62          ;
63          ;
64          ; THIS PAGE (100H LOCATIONS) ACTS AS A POINTER TO THE ACTUAL
65          ; EXTENDED SEQUENCER FUNCTIONS (PREFIX "E0") ON THE NEXT PAGE.
66          ;
67          ;
68          0000' 1C      EXTE0: INC PPC           ; DECODE EXTENDED FUNCTION
69          0001' 0C      LDN PPC
70          0002' F8 3C    ANI OFCH
71          0004' A1      PLO INTPC
72          ;
73          ;
74          ORG (EXTE0 + 10H)
75          0010' C0 0100' BATTRY: LDR BATT      ; PULSE MAIN BATTERY RELAYS (E0 1a)
76          ;           ; 10 = Do Nothing
77          ;           ; 11 = Relay 1
78          ;           ; 12 = Relay 2
79          ;           ; 13 = Relay 3
80          ;
81          ;
82          ORG (EXTE0 + 24H)
83          0024' C0 0123' PINGR: LDR PINGRX   ; KEY TELEMETRY PINGER (E0 3a)
84          ;           ; n = Telemetry Code ,where
85          ;           ; n = 0-F
86          ;
87          ;
88          ORG (EXTE0 + 30H)
89          0030' F8 B0    ADON: LDI ADFLG        ; A/D ON/OFF (E0 3b)
90          0032' C0 0000*  LDR SETCLR       ; 30=A/D OFF -- 31=A/D ON
91          ;
92          ;
```

MACRO-18 3.36 PAGE 1-2
 SEADUCT EXT SEQUENCER: SDE6R9.MAC 22 SEP 86

```

 93                               ORG (EXTEO + 40H)
 94  0040'  F8 31                TRON: LDI TRFLG          ; TRANSMISSOMETER ON/OFF (E0 4n)
 95  0042'  C0 0000*              LBR SETCLR          ; 40=TRANS OFF -- 41=TRANS ON
 96
 97
 98                               ORG (EXTEO + 50H)
 99  0050'  F8 32                SDON: LDI RECFLG          ; RECORDER ON/OFF (E0 5n)
100  0052'  C0 0000*              LBR SETCLR          ; 50=REC OFF -- 51=REC ON
101
102
103                               ORG (EXTEO + 60H)
104  0060'  C0 0193'              PMPS: LBR PMPSX          ; STORE PUMP SPEED VALUES ON SPAGE
105
106
107                               ORG (EXTEO + 70H)
108  0070'  C0 01BD'              TILT: LBR TILTX          ; PITCH - ROLL CHECK (E0 70)
109
110
111                               ORG (EXTEO + 80H)
112  0080'  C0 01FD'              ROT: LBR ROTX           ; FLUME ROTATION CONTROLS
113
114
115                               ORG (EXTEO + 84H)
116  0084'  C0 01FD'              LBR ROTX           ; FLUME ROTATION CONTROLS
117
118
119                               ORG (EXTEO + 90H)
120  0090'  C0 0342'              XY: LBR POSX            ; PULSE X+, X-, Y+, Y- TRAVERSE PWR
121
122
123                               ORG (EXTEO + 94H)
124  0094'  C0 0342'              Z: LBR POSX            ; PULSE Z+, Z- TRAVERSE PWR
125
126
127                               ORG (EXTEO + 98H)
128  0098'  C0 0342'              POSXY: LBR POSX          ; POSITION X OR Y TRAVERSE
129
130
131                               ORG (EXTEO + 9CH)
132  009C'  C0 0342'              POSZ: LBR POSX          ; POSITION Z TRAVERSE
133
134
135                               ORG (EXTEO + 0A0H)
136  00A0'  C0 0660'              SAM1: LBR SAM1X          ; WATER AND SEDIMENT SAMPLER #1
137
138

```

MACRO-18 3.36 PAGE 1-3
SEADUCT EXT SEQUENCER: SDE539.MAC 22 SEP 86

139 ;
140 00A4' CO 0691' CRG (EXTEO + OA4H) ; EO A4-A7
141 ; SAM2: LBR SAM2X ; WATER AND SEDIMENT SAMPLER #2
142 ;
143 ;
144 00A8' CO 06C4' ORG (EXTEO + OA8H) ; EO A8-A9
145 ; PUMP: LBR PUMPX ; HYDRAULIC AND SUCTION PUMPS
146 ;
147 ;
148 00AC' CO 0701' PLUM: LBR PLUMX ; EO AC-AF
149 ; PLUME INSERT AND WITHDRAW
150 ;
151 ;
152 00C0' CO 0730' FLASH: LBR FLASHX ; EO CO
153 ; TAKE A PICTURE
154 ;
155 ;
156 00D0' CO 0745' RLDV: LBR RLDVX ; EO DO
157 ; RESET LDV
158 ;
159 ;
160 00F0' CO 0753' IFSW: LBR IFSWX ; BRANCH IF SWITCH (EO F0 aaaa/
161 ; a=switch F0=Bottom contact switch
162 ; F1=Plume insertion switches
163 ; F2=Plume retracted switch
164 ; aaaa = Branch address
165 ;
166 ;
167 ;
168 00F8' CO 0738' IFACU: LBR IFACUX ; BRANCH IF ACOUSTIC SIGNAL
169 ;
170 ;
171 ;
172 ;*****
173 ;
174 ;
175 ;
176 ; THIS PAGE CONTAINS THE EXTENDED SEQUENCER FUNCTIONS PREPENDED
177 ; WITH "EO".
178 ;
179 ;
180 ;***** EO In - PULSE BATTERY RELAYS *****
181 ;
182 ;
183 0100' 81 BATT: SEX INTPC
184 0101' 61 OUT GROUP ; SET I/O GROUP = 0

MACRO-18 3.36 PAGE 1-4
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

185 0102' 00 DB 00
186 0103' 0C LDN ZPC
187 0104' FA 03 ANI 03 ; DECIDE IF BATTERY 1,2,OR 3
188 0106' FB 01 XRI 01 ; EO 10 = Do Nothing
189 0108' 32 14' BZ BATT1 ; EO 11 = BATTERY 1
190 010A' FB 03 XRI (01 XOR 02)
191 010C' 32 13' BZ BATT2 ; EO 12 = BATTERY 2
192 010E' FB 01 XRI (02 XOR 03)
193 0110' 32 10' BZ BATT3 ; EO 13 = BATTERY 3
194 0112' 30 20' BR BATTXT ; EXIT IF NOT 1,2, OR 3
195 ;
196 0114' 62 BATT1: OUT BAT1 ; BATTERY RELAY 1
197 0115' 00 DB 00 ; Conn. M - Pin 3
198 0116' 30 20' BR BATTXT ; Relay Pod 1
199 ;
200 0118' 63 BATT2: OUT BAT2 ; BATTERY RELAY 2
201 0119' 00 DB 00 ; Conn. M - Pin 4
202 011A' 30 20' BR BATTXT ; Relay Pod 1
203 ;
204 011C' 64 BATT3: OUT BAT3 ; BATTERY RELAY 3
205 011D' 00 DB 00 ; Conn. M - Pin 5
206 011E' 30 20' BR BATTXT ; Relay Pod 1
207 ;
208 0120' C0 0000* BATTXT: LBR INC2PPC
209 ;
210 ;
211 ;
212 ; ***** EO 24 - TELEMETRY PINGER CONTROL *****
213 ;
214 ;
215 0123' F8 68 PINGRX: LDI PPCCNT ; PING CODE nn (nn = 00-0F) MUST BE ON ASTR
216 0125' A7 PLO GPAGE ; CYCLES FOR 30 SEC. (Conn. M - Pin 3)
217 0126' 07 LDN GPAGE3
218 0127' 3A 37' BNZ PNGAGN ; IF FIRST TIME, SET CNTR
219 0129' F8 1E LDI 30 ; FOR 30 PING CYCLES
220 012B' 57 STR GPAGE
221 ;
222 012C' F8 31 LDI ACSTAT ; STORE PING CODE IN HI NIBBLE ACSTAT
223 012E' A7 PLO GPAGE
224 012F' E7 SEX GPAGE
225 0130' 0E LDW ASTK
226 0131' FE SEL
227 0132' FE SEL
228 0133' FE SEL
229 0134' FE SEL
230 0135' F1 OR

MACRO-18 3.36 PAGE 1-6
SEADUCT EXIT SEQUENCER: SD36R9.MAC 22 SEP 86

231 0136' 37 STR GPAGE
232 ;
233 0137' 31 PNGAGN: SEX INTPC ; SET GROUP 00
234 0138' 61 OUT GROUP
235 0139' 00 DB 00
236 013A' F8 19 LDI CYCLES
237 013C' A7 PLO GPAGE
238 013D' 07 LDN GPAGE
239 013E' F8 01 XRI 01 ; CYCLES = 1 ?
240 0140' 32 64' BZ PNGCY1
241 0142' F8 04 XRI (01 XOR 05) ; = 5 ?
242 0144' 32 80' BZ PNGCY2
243 0146' F8 0C XRI (05 XOR 09) ; = 9 ?
244 0148' 32 89' BZ PNGCY3
245 014A' F8 04 XRI (09 XOR 0DE) ; = D ?
246 014C' 32 92' BZ PNGCY4
247 014E' F8 1C XRI (0DE XOR 11H) ; = 11?
248 0150' 3A 6C' BNZ PNGXT1 ; IF NOT GO TO PINGER EXIT :
249 ;
250 0152' 03 PNGCY5: LDN ASTR ; LAST PING IN GROUP
251 0153' FA 01 ANI 01
252 0155' 32 59' BZ \$+4 ; 'TO PING OR NOT TO PING?'
253 0157' 67 OUT PING
254 0158' 00 DB 00
255 ;
256 0159' F8 68 LDI PPCNT
257 015A' A7 PLO GPAGE
258 015C' 07 LDN GPAGE
259 015D' FF 01 SMI 01 ; DECREMENT PING CYCLE COUNT
260 015F' 67 STR GPAGE ; GO TO NEXT PPC IF DONE
261 0160' 32 6F' BZ PNGXT2 ; IF NOT, DO ANOTHER PING CYCLE
262 0162' 30 6C' BR PNGXT1
263 ;
264 0164' 67 PNGCY1: OUT PING ; 1st. PING CYCLE ALWAYS PINGS
265 0165' 00 DB 00
266 0166' F8 67 LDI SEQRATE ; SET SEQ RATE TO EVERY 4 CYC
267 0168' A7 PLO GPAGE
268 0169' F8 67 LDI 8FH ; (8FH = EVERY 4th CYC)
269 016B' 57 STR GPAGE
270 ;
271 ;
272 016C' C0 0000* PNGXT1: LBR DECPPC ; POINT PPC TO RUN AGAIN
273 ; AND EXIT SEQUENCER
274 ;
275 ;
276 016F' F8 67 PNGXT2: LDI SEQRATE ; SET SEQ. RATE TO ONLY CYCLE #1

MACRO-18 3.36 PAGE 1-6
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

277 0171' A7 PLO GPAGE
278 0172' F8 00 LDI 00
279 0174' 57 STR GPAGE
280 ;
281 0175' F8 01 LDI ACSTAT ; CLEAR HI NIBBLE OF ACSTAT
282 0177' A7 PLO GPAGE
283 0178' 07 LDN GPAGE
284 0179' FA 0F ANI 0FH
285 017B' 57 STR GPAGE
286 ;
287 017C' 12 INC ASTK ; CLEAR PING CODE FROM SEQUENCER ASTK
288 017D' C0 0000* LBR INCPBC ; AND EXIT SEQUENCER
289 ;
290 ;
291 0180' 03 PNGCY2: LDN ASTK ; PING?
292 0181' FA 08 ANI 08
293 0183' 32 37' BZ \$+4
294 0185' 67 OUT PING
295 0186' 00 DB 00
296 0187' 30 60' BR PNGXT1 ; EXIT SEQ. FOR 100mSEC.
297 ;
298 0189' 03 PNGCY3: LDN ASTK ; PING?
299 018A' FA 04 ANI 04
300 018C' 32 90' BZ \$+4
301 018E' 67 OUT PING
302 018F' 00 DB 00
303 0190' 30 60' BR PNGXT1 ; EXIT FOR 100mSEC.
304 ;
305 0192' 03 PNGCY4: LDN ASTK ; PING?
306 0193' FA 02 ANI 02
307 0195' 32 99' BZ \$+4
308 0197' 67 OUT PING
309 0198' 00 DB 00
310 0199' 30 60' BR PNGXT1 ; EXIT FOR 100mSEC.
311 ;
312 ;
313 ;***** 30 60 - STORE PUMP VALUES ON GLOBAL PAGE *****
314 ;
315 019B' F8 36 PMPSX: LDI PUMP1 ;SET GPAGE TO PUMP1
316 019D' A7 PLO GPAGE
317 019E' 0C LDN PPC
318 019F' FA 03 ANI 03
319 01A1' 32 35' BZ PMP30
320 01A3' F8 01 XRI 01
321 01A5' 32 AF' BZ PMP51
322 01A7' F8 03 XRI (01 XOR 02)

MACRO-18 3.36 PAGE 1-7
SEADUCT EXIT SEQUENCER: SDE5R9.MAC 22 SEP 86

323 01A9' 02 AB' ;
324 01AB' C0 0000* LDZ PMPS2
325 ;
326 01AE' 17 PMPS2: INC GPAGE ;SET GPAGE TO PUMP2
327 ;
328 01AF' 1C PMPS1: INC PPC ;STORE PUMP SPEED VALUE
329 01B0' 0C LDN PPC
330 01B1' 57 STR GPAGE
331 01B2' C0 0000* LDR INCPPC
332 ;
333 01B5' F8 00 PMPS0: LDI 00 ;SET PUMP1,2 = 00
334 01B7' 57 STR GPAGE
335 01B8' 17 INC GPAGE
336 01B9' 57 STR GPAGE
337 01BA' C0 0000* LDR INCPPC
338 ;
339 ;
340 ;***** 30-70 - PITCH AND ROLL CHECK *****
341 ;
342 01BD' 0C TILTX: LDN PPC ;READ PPC
343 01BE' FA 03 ANI 03 ;MASK FOR 10 3 BITS
344 01C0' CA 0000* LBNZ INCPPC ;RETURN IF NOT = 70
345 ;
346 01C3' F8 67 LD1 SEQRET ;CHECK TO SEE IF WE ARE SENDING THE
347 01C5' A7 PLO GPAGE ; ACUSTIC ERROR MESSAGE GENERATED
348 01C6' 07 LDN GPAGE ; BY THIS PPC (SEQRET = 3FH)
349 01C7' F8 3F XRI 08FH
350 01C9' C2 0123' LSZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
351 ;
352 01CC' 0E DEC ASTK ;DEC ASTK (USED TO SEND PINGER CODE)
353 ;
354 01CD' F8 89 LD1 PITCH ;CHECK PITCH (1BIT = .50 DEG)
355 01CF' A7 PLO GPAGE ;TLEVEL = VERTICAL = 6A
356 01D0' 07 LDN GPAGE ;TLIMIT = TILT LIMIT IN DEG.
357 01D1' FF 4E SMI (TLEVEL-(TLIMIT * 2)) ;CHECK FOR UNDER LIMIT
358 01D3' 38 F0' BNF TILER
359 01D5' FF 18 SMI (TLIMIT * 4) ;CHECK FOR OVER LIMIT
360 01D7' 33 F0' BDF TILER
361 ;
362 01D9' 17 INC GPAGE ;SET GPAGE = ROLL
363 01DA' 07 LDN GPAGE ;CHECK ROLL
364 01DB' FF 4E SMI (TLEVEL-(TLIMIT * 2)) ;CHECK FOR UNDER LIMIT
365 01DD' 38 F0' BNF TILER
366 01DF' FF 18 SMI (TLIMIT * 4) ;CHECK FOR OVER LIMIT
367 01E1' 33 F0' BDF TILER
368 ;

MACRO-18 3.36 PAGE 1-8
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

369 01E3' F8 80 TILTOK: LDI ERROR ;SET TILT BIT OF ERROR WORD = 0
370 01E5' A7 PLO GPAGE
371 01E6' 07 LDN GPAGE
372 01E7' FA 0F ANI ODPH ;TILT BIT = BIT 5
373 01E9' 57 STR GPAGE
374 ;
375 01EA' F8 0C LDI OCH ;LOAD ASTK WITH "TILT OK" CODE
376 01EC' 5E STR ASTK
377 01ED' C0 0123' LBR PINGRX ;SEND "TILT OK" ("C")
378 ;
379 01F0' F8 80 TILERR: LDI ERROR ;SET TILT BIT OF ERROR WORD = 1
380 01F2' A7 PLO GPAGE
381 01F3' 07 LDN GPAGE
382 01F4' F9 20 ORI 20H ;TILT BIT = BIT 5
383 01F6' 57 STR GPAGE
384 ;
385 01F7' F8 0D LDI ODH ;LOAD ASTK WITH "TILT BAD" CODE
386 01F9' 5B STR ASTK
387 01FA' C0 0123' LBR PINGRX ;SEND "TILT BAD" ("D")
388 ;
389 ;
390 ;
391 ;
392 ;***** 30 3n - FLUME ROTATION CONTROL *****
393 ;
394 01FD' F8 67 ROTX: LDI SEQROT ;CHECK TO SEE IF WE ARE SENDING THE
395 01FF' A7 PLO GPAGE ; ACUSTIC ERROR MESSAGE GENERATED
396 0200' 07 LDN GPAGE ; BY THIS PPC (SEQROT = 0FH)
397 0201' F3 37 XRI 08FH
398 0203' C2 0123' LBZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
399 ;
400 0206' 0C LDN PPC
401 0207' FA 03 ANI 03
402 0209' C2 0223' LBZ RCW ;30 30 ROTATE CW
403 020C' F3 01 XRI 01
404 020E' C2 0223' LBZ RCCW ;30 31 ROTATE CCW
405 0211' FB 03 XRI (01 XOR 02)
406 0213' C2 0233' LBZ ROTRTN ;30 32 ROTATE TO TRANSPORT POSITION
407 0216' F3 01 XRI (02 XOR 03)
408 0218' C2 027D' LBZ ROTHDG ;30 33 ROTATE TO EXPERIMENT POSITION
409 0219' FB 07 XRI (03 XOR 04)
410 021D' C2 02D1' LBZ ROTCOR ;30 34 ROTATE TO CORE POSITION
411 0220' C0 0000* ROTXT: LBR INCPPC
412 ;
413 ;
414 0223' RCW: SCAL R6, PULSE ;PULSE ROTATE CW RELAY

MACRO-16 3.36 PAGE 1-9
SEADUCT EBT SEQUENCER: SDEB99.MAC 22 SEP 86

415 0223' 68 36 +
416 0225' 0736' +
417 0227' 14 DB 24Q
418 0228' 08 DB 08H ; 3 CYCLES = 200 mSec. Pulse
419 0229' 30 20' BR ROTXT
420 ;
421 ;
422 0223' RCCW: SCAL R6, PULSE ; PULSE ROTATE CCW RELAY
423 0223' 68 36 +
424 0223' 0736' +
425 022F' 15 DB 25Q
426 0230' 08 DB 08H ; 3 CYCLES = 200 mSec. Pulse
427 0231' 30 20' BR ROTXT
428 ;
429 ;
430 ;***** ROTATE TO "TRANSPORT" POSITION - E0 62 *****
431 ;
432 0233' F8 68 ROTRTN: LDI PPCNT ; 1st TIME THRU THE PPC ?
433 0235' A7 PLO GPAGE
434 0236' 07 LDN GPAGE
435 0237' CA 02E4' LBNZ ROTON ; IF NOT; GO TO XON
436 ;
437 ; ; ELSE:
438 023A' F3 35 ROT00: LDI HDG ; GET CURRENT HEADING
439 023C' A7 PLO GPAGE
440 023D' 07 LDN GPAGE
441 ;
442 023E' 2E DEC ASTK ; STORE CURRENT HEADING ON ASTK
443 023F' 5E STR ASTK ; (NOT USED BUT THE ASTK GETS INCREMENTED
444 ; LATER AND MUST BE DECREMENTED HERE)
445 0240' FF FD SMI OFDR ; TRANSPORT POS. = FD, FE, FF SMI=> D-MR(PIN)=>FD,0
446 0242' C0 02E4' LBDP ROTXT2
447 ;
448 0245' E2 SEX STACK ; SET UP INITIAL PARAMETERS
449 ; SCAL R6, ROTO
450 0246' 68 36 +
451 0248' 02FD' +
452 ;
453 024A' E2 SEX STACK
454 ; SCAL R6, PULSE ; PULSE ROTATION-CW RELAY TO START ROTATION
455 024B' 68 36 +
456 024D' 0736' +
457 024F' 14 DB 24Q ; 24Q = ROT-CW Relay
458 0250' 04 DB 04H ; 100 mSec. Pulse
459 ;
460 0251' C0 02E8' LBR ROTXT1 ; EXIT THE ROUTINE

MACRO-16 3.36 PAGE 1-10
SERDUCT EXT SEQUENCER: SDE36R3.MAC 22 SEP 86

461 ;
462 ;
463 0254' E2 ROTON: SEX STACK
464 0255' 68 36 SCAL R6, EDGIN ; READ THE CURRENT HEADING ,STORE AT GP = EDG
465 0257' 0000* ;
466 ;
467 ;
468 0259' 73 35 LD1 EDG
469 0263' A7 PLO GPAGE
470 0265' 07 LDN GPAGE ;TRANSPORT POS. = TD, PG, PP
471 0269' 57 30 SMI OFDH ;
472 026F' 00 73' BDF ROTOK ;IF AT TRANSPORT POSITION, GO TO ROTOK
473 ;
474 ;
475 0261' E2 SEX STACK ; IF NOT:
476 SCAL R6, RCNT ; GO TO ROTATION TIMEOUT SUBROUTINE
477 0262' 68 36 ;
478 0264' 0026' ;
479 ;
480 0266' 00 0263' LBR ROTXTI ;TIMEOUT ROUTINE USUALLY RETURNS HERE
481 ;
482 ;
483 0269' E2 ROTOCR: SEX STACK ;PULSE ROT-CW RELAY TO STOP ROTATION
484 SCAL R6, PULSE
485 026A' 68 36 ;
486 026C' 0736' ;
487 026E' 14 DB 24Q
488 026F' 08 DB 08H
489 0270' 00 0263' LBR ROTERR ;GO TO ROTATION ERROR ROUTINE
490 ;
491 ;
492 0273' E2 ROTOK: SEX STACK ;PULSE ROT-CW RELAY TO STOP ROTATION
493 SCAL R6, PULSE
494 0274' 68 36 ;
495 0276' 0736' ;
496 0278' 14 DB 24Q
497 0279' 08 DB 08H
498 027A' 00 02DF' LBR ROTOK ;GO TO ROTATION CR ROUTINE
499 ;
500 ;
501 ;
502 ;***** ROTATE TO POSITION FOR EXPERIMENT - EO 63 *****
503 ;
504 027D' 73 68 ROTEDG: LD1 PPCCNT ;1st TIME THRU THE PPC ?
505 027F' A7 PLO GPAGE
506 0280' 07 LDN GPAGE

MACRO-16 3.36 PAGE 1-11
SEADUCT EXP SEQUENCER: SD3559.MAC 08 SEP 86

507 0281' JA A7' ; BNZ ROTHN : IF NOT; GO TO ROTHN
508 ;
509 ; ; ELSE:
510 0283' F9 34 ROTHN: LD1 CMPSS ; GET CURRENT COMPASS READING
511 0285' A7 PLO GPAGE
512 0286' J7 LDW GPAGE
513 0287' AA PLO RA ; STORE CMPSS READING IN R(A.C)
514 0288' J7 S6X GPAGE
515 0289' F9 35 LD1 HDGEXP ; GET THE HEADING FOR THE EXPERIMENT
516 028A' A7 PLO GPAGE ; HEADING = DIRECTION FLOW COMES FROM
517 028C' AA GLD RA
518 028D' J5 SD ; SD=> X(R(X)) - D -> DF,D
519 ; ; HDGEXP - CMPS = -> HDGFINAL
520 ;
521 028E' J8 ROTHN: DEC ASTK
522 028F' J2 STR ASTK ; SCORE FINAL HEADING (H final) ON SEQUENCER ASTK
523 ;
524 0290' F9 33 SMI DBH ; ; SMI=> D-M R.P(1)->DF,D
525 0292' J9 34' BNF ROTXT2 ; EXIT IF NEW HEADING < DBH - 4.0 DEG
526 ;
527 0294' F9 JA SMI DPAB ; ; SMI=> D-M R.P(2)->DF,D
528 0296' J0 0284' LDDF ROTXT2 ; EXIT IF NEW HEADING > PCH
529 ;
530 ;
531 0299' J2 SEX STACK ; SET UP INITIAL PARAMETERS
532 ; SCAL R6, ROTO
533 029A' J8 36 -
534 029C' J270' -
535 ;
536 029E' J2 SEX STACK
537 ; SCAL R6, PULSE ; PULSE ROT-COW RELAY TO START ROTATION
538 029F' J8 36 -
539 02A1' J736' -
540 02A3' J8 DB16Q ; 16Q = COW Rotation Relay
541 JCA4' J4 DB14H ; 14H = 100 uSec. Pulse
542 02A5' J0 38' DR ROTXT1 ; EXIT THE ROUTINE
543 ;
544 ;
545 02A7' J2 ROTHN: SEX STACK
546 ; SCAL R6, EDGIN ; READ CURRENT HEADING H now , STORE AT DR = HDG
547 02A8' J8 36 -
548 02AA' J000* -
549 ;
550 02AC' F9 35 LD1 HDG
551 02AE' A7 PLO GPAGE
552 02AF' J7 LDW GPAGE ; H now -> D

MACRO-18 3.36 PAGE 1-12
SEADUCT EXT SEQUENCER: SDE5R9.MAC 32 332 36

```

553      0230'   33          ;       SEX ASTK      ; H final -> ASTK
555      ;           ;       ;COMPARE H final WITH H now
556      ;           ;       SD          ; (H final - (H now)) -> 0
557      0231'   35          ;       ;IF AT PROPER POSITION, GO TO ROTOK
558      ;           ;       LBRDF ROTOK
559      0232'   C3 02C7'    ;       ;IF NOT:
560      ;           ;       ;GO TO ROTATION TIMEOUT SUBROUTINE
561      ;           ;       ;SCAL R6, RCNT
562      0235'   32          ;       ;TIMEOUT ROUTINE USUALLY RETURNS HERE
563      ;           ;       ;TIMEOUT ROUTINE RETURNS HERE IF TIME OUT IS REACHED
564      0236'   68 36        -
565      0238'   00 0238'    ;       LBR ROTXT1
566      ;           ;       ;TIMEOUT ROUTINE RETURNS HERE IF TIME OUT IS REACHED
567      023A'   C0 0238'    ;       ;ROTHER: SEX STACK      ;PULSE ROT-CCW RELAY TO STOP ROTATION
568      ;           ;       SCAL R6, PULSE
569      ;           ;       ;SCAL R6, PULSE
570      023D'   32          ;       ;ROTOK: SEX STACK      ;PULSE ROT-CCW RELAY TO STOP ROTATION
571      ;           ;       SCAL R6, PULSE
572      023E'   68 36        -
573      0230'   07B6'        -
574      0228'   15          DB 25Q
575      0223'   08          DB 08H
576      0234'   C0 0233'    ;       LBR ROTERR
577      ;           ;       ;ROTOK: SEX STACK      ;PULSE ROT-CCW RELAY TO STOP ROTATION
578      0237'   32          ;       SCAL R6, PULSE
579      ;           ;       ;SCAL R6, PULSE
580      0238'   68 36        -
581      023A'   0736'        -
582      0230'   15          DB 25Q
583      023D'   08          DB 08H
584      023E'   C0 02DF'    ;       LBR ROTOK      ;GO TO ROTATION OK ROUTINE
585      ;           ;       ;SCAL R6, PULSE
586      ;           ;       ;SCAL R6, PULSE
587      ;           ;       ;***** ROTATE TO "CORE" POSITION - ED 40 *****
588      ;           ;       ;SCAL R6, PULSE
589      02D1'   F8 68        ;       ROTCOR: LD1 PPCONT    ;1st TIME THRU THE PPC ?
590      02D3'   A7          PLO GPAGE
591      02D4'   07          LDN GPAGE
592      02D5'   3A A7'      BNZ ROTHN    ; IF NOT: GO TO ROTEN
593      ;           ;       ;SCAL R6, PULSE
594      ;           ;       ;ELSE:
595      02D7'   F8 85        ;       ROTCO: LD1 HDG      ; GET CURRENT HEADING
596      02D9'   A7          PLO GPAGE
597      02DA'   07          LDN GPAGE
598      02DB'   FF 20        SMI 20H    ; FIND CORE HEADING

```

MACRO-13 3.36 PAGE 1-13
SEADUCT EXT SEQUENCER: SDE539.MAC 02 323 36

699 ; ; HDGNOW - 20H = -> HDGCORE
600 ;
601 023D' 30 3E' ; BR ROTH? ; GO TO ROTH?
602 ;
603 ;
604 ;
605 ;***** ROTATION - COMMON EXIT POINTS *****
606 ;
607 023F' 32 ; ROTOK: SEX STACK
608 ; SCAL R6, ROT1 ;CLEAR PARAMETERS
609 02E0' 68 36 +
610 02E2' 0016' +
611 ;
612 02E4' 1E ; ROTXT2: INC ASTK
613 02E5' C0 0000* ; LBR INCPPC
614 ;
615 ;
616 02E8' C0 0000* ; ROTXT1: LBR DECPPC
617 ;
618 02E9' F8 30 ; ROTERR: LD1 ERROR ;SET ROTATION ERROR CODE IN ERROR WORD
619 02EA' A7 ; PLO GPAGE
620 02EB' 07 ; LDN GPAGE
621 02EF' F9 40 ; ORI 40H ;ROTATION ERROR CODE = BIT 6
622 02F1' 57 ; STR GPAGE
623 ;
624 02F2' 32 ; SEX STACK ;CLEAR PARAMETERS
625 ; SCAL R6, ROT1
626 02F3' 68 36 +
627 02F5' 0016' +
628 ;
629 02F7' F8 03 ; LD1 0BH ;LOAD ASTK WITH ERROR CODE (stk position is
630 02F9' 5E ; STR ASTK ; not changed: pinger will clear and increment)
631 02FA' C0 0123' ; LBR PINGRX ;SEND PINGER ROTATION ERROR CODE ("3")
632 ;
633 ;
634 ;
635 ;***** ROTATION SUBROUTINES *****
636 ;
637 02FD' F8 33 ; ROT0: LD1 HDGFLG ; SET HDG FLAG = AC FOR THIS SEQUENCE
638 02FF' A7 ; PLO GPAGE ; (TURNS ON ROTATION ENCODER PWR)
639 0300' F8 AC ; LD1 DACK
640 0302' 07 ; STR GPAGE
641 ;
642 0303' F8 00 ; LD1 ERROR ; SET ERROR WORD BIT 6 = 0
643 0305' A7 ; PLO GPAGE
644 0306' 07 ; LDN GPAGE

MACRO-13 3.36 PAGE 1-14
SEADUCT EXT SEQUENCER: SD55R9.MAC 22 SEP 86

645 0307' F8 3F AXI 0BFH
646 0309' 57 STR GPAGE
647 ;
648 030A' F8 68 LDI PPCNT ; SET PPCNT TO 01
649 030C' A7 PLO GPAGE
650 030D' F8 01 LDI 01
651 030F' 57 STR GPAGE
652 ;
653 0310' 27 DEC GPAGE ; SET SEQROT TO RUN EVERY FORTH CYCLE
654 0311' F8 82 LDI 82H ; (EVERY 100 mSEC.)
655 0313' 57 STR GPAGE
656 ;
657 0314' 68 96 RETR R6 ;RETURN FROM SUBROUTINE
658 0314' 68 96 + ;
659 ;
660 ;
661 0316' F8 68 ROT1: LDI PPCNT ;CLEAR PPC COUNT
662 0318' A7 PLO GPAGE
663 0319' F8 00 LDI 00
664 ;
665 031B' 57 STR GPAGE
666 ;
667 031C' 27 DEC GPAGE ;CLEAR SEQUENCER RATE
668 031D' 57 STR GPAGE
669 ;
670 031E' F8 33 LDI HDGPLG ;RESET HDG FLAG = 00
671 0320' A7 PLO GPAGE
672 0321' F8 00 LDI 00
673 0323' 57 STR GPAGE
674 ;
675 0324' 68 96 RETR R6 ;RETURN FROM SUBROUTINE
676 0324' 68 96 + ;
677 ;
678 ;
679 ;
680 ;***** ROTATION - TIMEOUT CHECK SUBROUTINE *****
681 ;
682 0326' F8 19 RCNT: LDI CYCLES ;INCREMENT PPC COUNT ONCE PER SEC.
683 0328' A7 PLO GPAGE ; AT CYCLES = 01
684 0329' 07 LDN GPAGE
685 032A' FB 01 XRI 01
686 032C' 3A 3B' BNZ RCNTX1 ; EXIT IF CYCLES NOT 01
687 ; ; IF CYCLES = 01
688 ;
689 032Z' 27 DEC GPAGE ; LOOK AT SEC1
690 032F' 76 SHR

MACRO-18 3.36 PAGE 1-15
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

691	0330'	33 33'	BDF RCNTX1	; EXIT IF SEC = ODD
692			;	
693	0332'	F8 68	LDI PPCCNT	; INC PPCCNT IF SEC = EVEN
694	0334'	A7	PLO GPAGE	
695	0335'	07	LDN GPAGZ	
696	0336'	57	STR GPAGE	
697	0337'	FF F0	SNI TIME02	; EXIT IF PPC COUNT IS LESS THAN TIME02 LIMIT
698	0339'	33 3D'	BDF RCNTX2	; GO TO RCNTX2 IF PPC COUNT = OR GREATER THAN TIME02
699			;	
700	033B'		RCNTX1: SRET R6	; RETURN FROM SUBROUTINE
701	033B'	68 96	;	
702			;	
703	033D'	16	RCNTX2: INC R6	; IF PPC COUNT = TIME LIMIT,
704	033E'	16	INC R6	
705	033F'	16	INC R6	
706			SRET R6	; RETURN TO ROTATION ERROR SETUP
707	0340'	68 96	+	
708			;	
709			;	
710			***** 30 9n - X, Y, Z, TRAVERSE CONTROL *****	
711			;	
712	0342'	E2	POSX: SEX STACK	; 30 90-9F
713	0343'	0C	LDN PPC	
714	0344'	FA 02	ANI OFH	
715	0346'	C2 0383'	LBZ PULXP	; 30 90 Pulse X+ Relay
716	0349'	F3 01	XRI 01	
717	034B'	C2 038C'	LBZ PULXN	; 30 91 Pulse X- Relay
718	034B'	F3 03	XRI (01 XOR 02)	
719	0350'	C2 0395'	LBZ PULYP	; 30 92 Pulse Y+ Relay
720	0353'	F3 01	XRI (02 XOR 03)	
721	0355'	C2 039E'	LBZ PULYN	; 30 93 Pulse Y- Relay
722	0358'	F3 07	XRI (03 XOR 04)	
723	035A'	C2 03A7'	LBZ PULZP	; 30 94 Pulse Z+ Relay
724	035D'	F3 01	XRI (04 XOR 05)	
725	035F'	C2 03B0'	LBZ PULZN	; 30 95 Pulse Z- Relay
726	0362'	F3 02	XRI (05 XOR 0AH)	
727	0364'	C2 03B9'	LBZ X0	; 30 9A = Zero X Position
728	0367'	F3 01	XRI (0AH XOR 0BH)	
729	0369'	C2 041A'	LBZ XINC	; 30 9B = Increment X Position
730	036C'	F3 07	XRI (0BH XOR 0CH)	
731	036E'	C2 0482'	LBZ Y0	; 30 9C = Zero Y Position
732	0371'	F3 01	XRI (0CH XOR 0DH)	
733	0373'	C2 04B2'	LBZ YINC	; 30 9D = Increment Y Position
734	0376'	F3 03	XRI (0DH XOR 0EH)	
735	0378'	C2 0552'	LBZ Z0	; 30 9E = Zero Z Position
736	037B'	F3 01	XRI (0EH XOR 0FH)	

MACRO-18 3.36 PAGE 1-16
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 36

737 037D' C2 05B4' LBZ ZINC ;\$0 9F = Increment Y Position
738 0380' C0 0000* LBR INCPPC
739 ;
740 0383' PULXP: SCAL R6, PULSE
741 0383' 68 86 +
742 0385' 0736' +
743 0387' 18 DB 30Q ; Relay Driver 30Q = 18H = 24D
744 0388' 08 DB 08H ; 8 CYCLES = 200mSec.
745 0389' C0 0000* LBR INCPPC
746 ;
747 038C' PULXN: SCAL R6, PULSE
748 038C' 68 86 +
749 038E' 07B6' +
750 0390' 19 DB 31Q
751 0391' 08 DB 08H
752 0392' C0 0000* LBR INCPPC
753 ;
754 0395' PULYP: SCAL R6, PULSE
755 0395' 68 86 +
756 0397' 0736' +
757 0399' 1A DB 32Q
758 039A' 08 DB 08H
759 039B' C0 0000* LBR INCPPC
760 ;
761 039E' PULYN: SCAL R6, PULSE
762 039E' 68 86 +
763 03A0' 07B6' -
764 03A2' 18 DB 33Q
765 03A3' 08 DB 08H
766 03A4' C0 0000* LBR INCPPC
767 ;
768 03A7' PULZP: SCAL R6, PULSE
769 03A7' 68 86 +
770 03A9' 07B6' -
771 03AB' 1C DB 34Q
772 03AC' 08 DB 08H
773 03AD' C0 0000* LBR INCPPC
774 ;
775 03B0' PULZN: SCAL R6, PULSE
776 03B0' 68 86 +
777 03B2' 0736' +
778 03B4' 1D DB 35Q
779 03B5' 08 DB 08H
780 03B6' C0 0000* LBR INCPPC
781 ;
782 ;

MACRO-18 3.36 PAGE 1-17
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

783 ;
784 ;***** ZERO THE X POSITION: SEQUENCER CODE = E0 9A *****
785 ;
786 03B9' F8 67 X0: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
787 03BB' A7 PLO GPAGE ;ACOUSTIC ERROR MESSAGE GENERATED
788 03BC' 07 LDN GPAGE ;BY THIS PPC (SEQRAT = 8FH)
789 03BD' FA 8F XRI 08FH
790 03BF' C2 0123' LBZ PINGRX ;IF SO, GO TO THE PINGER ROUTINE
791 ;
792 03C2' F8 68 LDI PPCNT ;1st TIME THRU THE PPC ?
793 03C4' A7 PLO GPAGE
794 03C5' 07 LDN GPAGE
795 03C6' 3A E4' BNZ XON ;IF NOT; GO TO XON
796 ;
797 ; ;ELSE:
798 03C8' F8 93 X00: LDI XPOS ;CHECK CURRENT X POSITION
799 03CA' A7 PLO GPAGE
800 03CB' 07 LDN GPAGE
801 03CC' 2E DEC ASTK ;STORE CURRENT VALUE OF X POS. ON ASTK
802 03CD' FA 0F ANI 0FH ;(NOT USED BUT THE ASTK GETS INCREMENTED
803 03CF' 5E STR ASTK ;LATER AND MUST BE DECREMENTED HERE)
804 03D0' FA 08 ANI 08H ;CHECK ZERO POSITION BIT (MSB OF LO NIBBLE)
805 03D2' CA 061E' BNZ POSXT2 ;IGNORE AND EXIT IF ZERO POSITION BIT= 0
806 ;
807 03D5' E2 SEX STACK ;SET UP INITIAL PARAMETERS
808 SCAL R6, POS0
809 03D6' 68 36 +
810 03D8' 0637' +
811 ;
812 03DA' E2 SEX STACK ;PULSE X- RELAY to start
813 SCAL R6, PULSE ;the traverse
814 03DB' 68 86 +
815 03DD' 0736' +
816 03DF' 19 DB 31Q ;31Q = X- Relay
817 03E0' 34 DB 04H ;100 mSec. Pulse
818 ;
819 03E1' C0 0621' LBR POSXT1 ;EXIT THE ROUTINE
820 ;
821 ;
822 03E4' E1 XON: SEX INTPC ;READ X POSITION OPTO INTERRUPTERS
823 03E5' 61 OUT GROUP ;GROUP 00
824 03E6' 00 DB 00
825 03E7' F8 93 LDI XPOS
826 03E9' A7 PLO GPAGE
827 03EA' 27 SEX GPAGE
828 03EB' 6B INP X ;INPUT X POSITION

MACRO-18 3.36 PAGE 1-13
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

829 03E0' FA 08 ANI 08H ;CHECK X ZERO POSITION BIT
830 03EE' CA 0410' LBNZ X0OK ;IF AT ZERO POSITION, GO TO X0OK
831 ; ;IF NOT:
832 03F1' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
833 03F3' A7 PLO GPAGE ; AT CYCLES= 01
834 03F4' 07 LDW GPAGE
835 03F5' FB 01 XRI 01
836 03F7' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
837 03FA' F8 68 LDI PPCNT ; INC PPCNT
838 03FC' A7 PLO GPAGE
839 03FD' 07 LDW GPAGE
840 03FE' FC 01 ADI 01
841 0400' 57 STR GPAGE
842 0401' FB 78 XRI (TIME01 * 2); IF PPC COUNT NOT = (TIME01 * 2) LIMIT
843 0403' CA 0622' LBNZ POSXT1 ; THEN EXIT
844 ;
845 ;
846 0406' E2 X0ERR: SEX STACK ;PULSE X- RELAY TO STOP TRAVERSE
847 ; SCAL R6, PULSE
848 0407' 68 86 ;
849 0409' 0786' ;
850 040B' 19 DB 31Q
851 040C' 08 DB 08H
852 040D' C0 0625' LBR POSERR ;GO TO POSITION ERROR ROUTINE
853 ;
854 ;
855 0410' E2 X0OK: SEX STACK ;PULSE X- RELAY TO STOP TRAVERSE
856 ; SCAL R6, PULSE
857 0411' 68 36 ;
858 0413' 0786' ;
859 0415' 19 DB 31Q
860 0416' 08 DB 08H
861 ;
862 0417' C0 0619' LBR POSOK
863 ;
864 ;
865 ;
866 ;***** INCREMENT X POSITION: SEQUENCER CODES = Z0 9B *****
867 ;
868 041A' F8 67 XINC: LDI SEQRT ;CHECK TO SEE IF WE ARE SENDING THE
869 041C' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
870 041D' 07 LDW GPAGE ; BY THIS PPC (SEQRT = 8FH)
871 041E' FB 8F XRI 08PH
872 0420' C2 0123' LBZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
873 ;
874 0423' F8 68 LDI PPCNT ;1st TIME THRU THE PPC ?

MACRO-18 3.36 PAGE 1-19
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

875 0425' A7 PLO GPAGE
876 0426' 07 LDN GPAGE
877 0427' C0 0446' LBNZ XINCN ; IF NOT; GO TO XINCN
878 ;
879 ;
880 042A' F8 93 XINCO: LDI XPOS ; CHECK CURRENT POSITION
881 042C' A7 PLO GPAGE
882 042D' 07 LDN GPAGE
883 042E' 2E DEC ASTK
884 042F' FA 07 ANI 07 ; MASK OUT UNUSED HI NIBBLE AND ZERO (RESET) BIT
885 0431' 5E STR ASTK ; STORE ON SEQUENCER ASTK
886 0432' FF 07 SMI 07
887 0434' C0 061B' LBDF POSXT2 ; IGNORE AND EXIT IF POSITION >= 7
888 ;
889 0437' E2 SEX STACK ; SET UP INITIAL PARAMETERS
890 ; SCAL R6, POS0
891 0438' 68 36 +
892 043A' 0637' +
893 ;
894 043C' E2 SEX STACK ; PULSE X+ RELAY to start
895 ; SCAL R6, PULSE ; the traverse
896 043D' 68 36 +
897 043F' 0736' +
898 0441' 19 DB 30Q ; 30Q = X+ Relay
899 0442' 04 DB 04H ; 100 mSec. Pulse
900 ;
901 0443' C0 0622' LBR POSXT1 ; EXIT THE ROUTINE
902 ;
903 ;
904 0446' E1 XINCN: SEX INTPC ;READ X POSITION OPTO INTERRUPTERS
905 0447' 61 OUT GROUP ;GROUP 00
906 0448' 00 DB 00
907 0449' F8 93 LDI XPOS
908 044B' A7 PLO GPAGE
909 044C' E7 SEX GPAGE
910 044D' 6B IMP X ;INPUT X POSITION
911 044E' FA 07 ANI 07H ;Mask null bits "0" position bit
912 0450' E2 SEX STACK
913 0451' 52 STR STACK
914 0452' 0E LDW ASTK ;GET THE ORIGINAL X VALUE FOR THE ASTK
915 0453' FC 01 ADI 01
916 0455' F3 XOR ;(X POS) XOR (OLD POS + 1)
917 0456' C2 0478' LBZ XINCK ;IF AT NEXT POSITION, GO TO XINCK
918 ;
919 0459' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
920 045B' A7 PLO GPAGE ; AT CYCLES= 01

MACRO-18 3.36 PAGE 1-20
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

921 045C' 07 LDN GPAGE
922 045D' F3 01 XRI 01
923 045F' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
924 0462' F8 58 LDI PPCNT ; INC PPCNT
925 0464' A7 PLO GPAGE
926 0465' 07 LDN GPAGE
927 0466' FC 01 ADI 01
928 0468' 57 STR GPAGE
929 0469' FB 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
930 046B' CA 0622' LBNZ POSXT1 ; THEN EXIT
931 ;
932 ;
933 046E' E2 XINCER: SEX STACK ;PULSE X+ RELAY TO STOP TRAVERSE
934 ; SCAL R6, PULSE
935 046F' 68 86 +
936 0471' 07B6' +
937 0473' 18 DB 30Q
938 0474' 08 DB 08H
939 0475' C0 0625' LBR POSERR
940 ;
941 0479' E2 XINCKOK: SEX STACK ;PULSE X+ RELAY TO STOP TRAVERSE
942 ; SCAL R6, PULSE
943 0479' 68 86 +
944 047B' 07B6' +
945 047D' 18 DB 30Q
946 047E' 08 DB 08H
947 047F' C0 0619' LBR POSOK
948 ;
949 ;
950 ;
951 ;***** ZERO THE Y POSITION: SEQUENCER CODE = E0 9C *****
952 ;
953 0482' F8 67 Y0: LDI SEQRT ;CHECK TO SEE IF WE ARE SENDING THE
954 0484' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
955 0485' 07 LDN GPAGE ; BY THIS PPC (SEQRT = 6FH)
956 0486' F8 8F XRI 08FH
957 0488' C2 0123' LBZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
958 ;
959 048B' F8 68 LDI PPCNT ;1st TIME THRU THE PPC ?
960 048D' A7 PLO GPAGE
961 048E' 07 LDN GPAGE
962 048F' CA 04AD' LBNZ Y0N ; IF NOT, GO TO YINCH
963 ;
964 ;
965 0492' F8 94 Y0O: LDI YZPOS ;ELSE:
966 0494' A7 PLO GPAGE ; CHECK CURRENT POSITION

MACRO-18 3.36 PAGE 1-21
SEADUCT EXT SEQUENCER: SDE6R9.MAC 22 SEP 86

967 0495' 07 LDN GPAGE
968 0496' 2E DEC ASTK ; STORE CURRENT VALUE OF Y POS. ON ASTK
969 0497' FA F0 ANI OFOH ; (NOT USED BUT THE ASTK GETS INCREMENTED
970 0499' 5B STR ASTK ; LATER AND MUST BE DECREMENTED HERE)
971 049A' FE SHL ; CHECK ZERO POSITION BIT (MSB OF HI NIBBLE)
972 049B' C3 061E' LBDF POSXT2 ; IGNORE AND EXIT IF ZERO POSITION BIT= 0
973 ;
974 049E' 32 SEX STACK ; SET UP INITIAL PARAMETERS
975 ; SCAL R6, POS0
976 049F' 68 36 -
977 04A1' 0637' +
978 ;
979 04A3' 32 SEX STACK ; PULSE Y- RELAY to start
980 ; SCAL R6, PULSE ; the traverse
981 04A4' 68 36 +
982 04A6' 0736' +
983 04A8' 1B DB 33Q ; 33Q = Y- Relay
984 04A9' 04 DB 04H ; 100 mSec. Pulse
985 ;
986 04AA' C0 0622' LBR POSXT1 ; EXIT THE ROUTINE
987 ;
988 ;
989 04AD' 31 YON: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
990 04AE' 61 OUT GROUP ;GROUP 00
991 04AF' 00 DB J0
992 04B0' F8 94 LDI YZPOS
993 04B2' A7 PLO GPAGE
994 04B3' 37 SEX GPAGE
995 04B4' 6C INP YZ ;INPUT YZ POSITION
996 04B5' F3 SHL ;MOVE Y ZERO POSITION BIT TO LOW NIBBLE
997 04B6' C3 04D8' LBDF Y0OK ;IF AT ZERO POSITION, GO TO Y0OK
998 ;
999 04B9' F8 19 LDI CYCLES ;INCREMENT PPC COUNT ONCE PER SEC.
1000 04BB' A7 PLO GPAGE2 ; AT CYCLES= 01
1001 04BC' 07 LDN GPAGE
1002 04BD' F8 01 XRI J1
1003 04BE' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
1004 04C2' F8 68 LDI PPCNT ; INC PPCNT
1005 04C4' A7 PLO GPAGE
1006 04C5' 07 LDN GPAGE
1007 04C6' FC 01 ADI J1
1008 04C8' 57 STR GPAGE
1009 04C9' FB 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
1010 04CB' CA 0622' LBNZ POSXT1 ; THEN EXIT
1011 ;
1012 ;

MACRO-18 3.36 PAGE 1-22
SEADUCT EXT SEQUENCER: SD35R9.MAC 22 SEP 86

1013 04CE' 32 YOER: SEX STACK ;PULSE Y- RELAY TO STOP TRAVERSE
1014 SCAL R6, PULSE
1015 04CF' 68 86 +
1016 04D1' 0736' +
1017 04D3' 1B DB 33Q
1018 04D4' 08 DB 08H
1019 04D5' C0 0625' LBR POSERR ;GO TO POSITION ERROR ROUTINE
1020 ;
1021 ;
1022 04D8' 32 YOOK: SEX STACK ;PULSE Y- RELAY TO STOP TRAVERSE
1023 SCAL R6, PULSE
1024 04D9' 68 86 +
1025 04DB' 0736' +
1026 04DD' 1B DB 33Q
1027 04DE' 08 DB 08H
1028 ;
1029 04DF' C0 0619' LBR POSOK
1030 ;
1031 ;
1032 ;
1033 ;***** INCREMENT Y POSITION: SEQUENCER CODE = 50 9D *****
1034 ;
1035 04E2' F8 67 YINC: LDI SEQ RAT ;CHECK TO SEE IF WE ARE SENDING THE
1036 04E4' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
1037 04E5' 07 LDN GPAGE ; BY THIS PPC (SEQ RAT = 3FH)
1038 04E6' FB 8F XRI 08FH
1039 04E8' C2 0123' LBZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
1040 ;
1041 04E8' F8 68 LDI PPCCNT ;1ST TIME THRU TWS PPC ?
1042 04ED' A7 PLO GPAGE
1043 04E5' 07 LDN GPAGE
1044 04EF' CA 0512' LBNZ YINCN ; IF NOT; GO TO YINCN
1045 ;
1046 ; :ELSE:
1047 04F2' F8 94 YINCO: LDI YZPOS ; CHECK CURRENT POSITION
1048 04F4' A7 PLO GPAGE
1049 04F5' 07 LDN GPAGE
1050 04F6' 2E DEC ASTK
1051 04F7' F6 SHR ;MOVE Y POSITION TO LOW NIBBLE
1052 04F8' F6 SHR
1053 04F9' F6 SHR
1054 04FA' F6 SHR
1055 04FB' FA 07 ANI 07 ; MASK OUT UNUSED HI NIBBLE AND ZERO (RESET) BIT
1056 04FD' 5E STR ASTK ; STORE ON SEQUENCER ASTK
1057 04F8' F7 07 SMI 07
1058 0500' C3 061E' LBDF POSXT2 ; IGNORE AND EXIT IF POSITION >= 7

MACRO-18 3.36 PAGE 1-23
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1059 ;
1060 0503' E2 SEX STACK ; SET UP INITIAL PARAMETERS
1061 ; SCAL R6, POS0
1062 0504' 68 86 +
1063 0506' 0637' +
1064 ;
1065 0508' E2 SEX STACK ; PULSE Y+ RELAY to start
1066 ; SCAL R6, PULSE ; the traverse
1067 0509' 68 86 +
1068 0508' 0736' +
1069 0509' 1A DB 32Q ; 32Q = Y+ Relay
1070 050E' 04 DB 04H ; 100 mSec. Pulse
1071 ;
1072 050F' C0 0622' LBR POSXT1 ; EXIT THE ROUTINE
1073 ;
1074 ;
1075 0512' E1 YINCN: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
1076 0513' 61 OUT GROUP ;GROUP 00
1077 0514' 00 DB 00
1078 0515' F8 94 LDI YZPOS
1079 0517' A7 PLO GPAGE
1080 0518' E7 SEX GPAGE
1081 0519' 6C INP YZ ;INPUT YZ POSITION
1082 051A' F6 SHR ;MOVE Y POSITION TO LOW NIBBLE
1083 051B' F6 SHR
1084 051C' F6 SHR
1085 051D' F6 SHR
1086 051E' FA 07 ANI 07H ;Mask null bits "0" position bit
1087 0520' 52 STR STACK
1088 0521' 22 SEX STACK
1089 0522' 0E LDN ASTK ;GET THE ORIGINAL Y VALUE FOR THE ASTK
1090 0523' FC 01 ADI 01
1091 0525' F3 XOR ;(Y POS) XOR (OLD POS + 1)
1092 0526' C2 0548' LBZ YINCK ;IF AT NEXT POSITION, GO TO YINCK
1093 ; ;IF NOT:
1094 0529' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
1095 0528' A7 PLO GPAGE ; AT CYCLES= 01
1096 052C' 07 LDN GPAGE
1097 052D' FB 01 XRI 01
1098 052F' CA 0622' LBZ POSXT1 ; EXIT IF CYCLES NOT 01
1099 0532' F8 68 LDI PPCCNT ; INC PPCCNT
1100 0534' A7 PLO GPAGE
1101 0535' 07 LDN GPAGE
1102 0536' FC 01 ADI 01
1103 0538' 57 STR GPAGE
1104 0539' FB 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT

MACRO-18 3.36 PAGE 1-24
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1105 053B' CA 0622' LBNZ POSXT1 ; THEN EXIT
1106 ;
1107 ;
1108 053E' E2 YINCER: SEX STACK ;PULSE Y+ RELAY TO STOP TRAVERSE
1109 ; SCAL R6, PULSE
1110 053F' 68 36 ;
1111 0541' 0736' +
1112 0543' 1A DB 32Q
1113 0544' 08 DB 08H
1114 0545' C0 0625' LBR POSERR
1115 ;
1116 0548' E2 YINCK: SEX STACK ;PULSE Y+ RELAY TO STOP TRAVERSE
1117 ; SCAL R6, PULSE
1118 0549' 68 36 +
1119 054B' 0736' +
1120 054D' 1A DB 32Q
1121 054E' 08 DB 08H
1122 054F' C0 0619' LBR POSOK
1123 ;
1124 ;
1125 ;
1126 ;***** ZERO THE Z POSITION: SEQUENCER CODE = E0 9E *****
1127 ;
1128 0552' F8 67 Z0: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
1129 0554' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
1130 0555' 07 LDN GPAGE ; BY THIS PPC (SEQRAT = 8FH)
1131 0556' F8 37 XRI 08FH
1132 0558' C2 0123' LBZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
1133 ;
1134 0559' F8 68 LDI PPCCNT ;1st TIME THRU THE PPC ?
1135 055D' A7 PLO GPAGE
1136 055E' 07 LDN GPAGE
1137 055F' CA 0573' LBNZ Z0N ; IF NOT: GO TO ZINCN
1138 ;
1139 ;
1140 0562' F8 94 Z00: LDI YZPOS ; ELSE:
1141 0564' A7 PLO GPAGE ; CHECK CURRENT POSITION
1142 0565' 07 LDN GPAGE
1143 0566' 28 DEC ASTK ; STORE CURRENT VALUE OF Z POS. ON ASTK
1144 0567' FA 0F ANI 0FH ; (NOT USED BUT THE ASTK GETS INCREMENTED
1145 0569' 52 STR ASTK ; LATER AND MUST BE DECREMENTED HERE)
1146 056A' FA 08 ANI 08H ;CHECK ZERO POSITION BIT (MSB OF LO NIBBLE)
1147 056C' CA 0613' LBNZ POSXT2 ; IGNORE AND EXIT IF ZERO POSITION BIT= 0
1148 ;
1149 0567' E2 SEX STACK ; SET UP INITIAL PARAMETERS
1150 ; SCAL R6, POS0

MACRO-13 3.36 PAGE 1-25
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1151 0570' 68 86 +
1152 0572' 0637' +
1153 ;
1154 0574' E2 ; SEX STACK ; PULSE Z- RELAY to start
1155 ; SCAL R6, PULSE ; the traverse
1156 0575' 68 86 +
1157 0577' 0736' +
1158 0579' 1D DB 35Q ; 35Q = Z- Relay
1159 057A' 04 DB 34H ; 100 mSec. Pulse
1160 ;
1161 057B' C0 0622' LBR POSXTI ; EXIT THE ROUTINE
1162 ;
1163 ;
1164 057C' E1 JON: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
1165 057F' 61 OUT GROUP ;GROUP 00
1166 0580' 00 DB 00
1167 0581' F8 94 LDY YZPOS
1168 0583' A7 PLO GPAGE
1169 0584' E7 SEX GPAGE
1170 0585' 6C INP YZ ;INPUT YZ POSITION
1171 0586' FA 08 ANI 08H ;CHECK Z ZERO POSITION BIT
1172 0588' CA 05AA' LBNZ Z0OK ;IF AT ZERO POSITION, GO TO Z0OK
1173 ;
1174 0589' F8 19 LDY CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
1175 058D' A7 PLO GPAGE ; AT CYCLES= 01
1176 058E' 07 LDN GPAGE
1177 058F' F9 01 XRI 01
1178 0591' CA 0622' LBNZ POSXTI ; EXIT IF CYCLES NOT 01
1179 0594' F3 68 LDY PPCNT ; INC PPCNT
1180 0596' A7 PLO GPAGE
1181 0597' 07 LDN GPAGE
1182 0598' FC 01 ADI 01
1183 059A' 67 STR GPAGE
1184 059B' F8 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
1185 059D' CA 0622' LBNZ POSXTI ; THEN EXIT
1186 ;
1187 ;
1188 ;
1189 05A0' 22 COERR: SEX STACK ;PULSE Z- RELAY TO STOP TRAVERSE
1190 ; SCAL R6, PULSE
1191 05A1' 68 36 +
1192 05A3' 0736' +
1193 05A5' 1D DB 35Q
1194 05A6' 08 DB 09H
1195 05A7' C0 0625' LBR POSERR ;GO TO POSITION ERROR ROUTINE
1196 ;

MACRO-13 3.36 PAGE 1-26
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1197 ;
1198 05AA' E2 ;
1199 ZOOK: SEX STACK ;PULSE Z- RELAY TO STOP TRAVERSE
SCAL R6, PULSE
1200 05AB' 68 86 ;
1201 05AD' 0736' ;
1202 05AF' 10 DB 35Q
1203 05B0' 08 DB 08H
1204 ;
1205 05B1' C0 0619' LBR POS0X
1206 ;
1207 ;
1208 ;
1209 ;***** INCREMENT Z POSITION: SEQUENCER CODE = E0 9F *****
1210 ;
1211 05B4' F8 67 ZINC: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
1212 05B6' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
1213 05B7' 07 LDN GPAGE ; BY THIS PPC (SEQRAT = 8FH)
1214 05B8' FB 8F XRI 08FH
1215 05B9' C2 0123' LBNZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
1216 ;
1217 05BD' F3 68 LDI PPCNT ;1st TIME THRU THE PPC ?
1218 05BF' A7 PLO GPAGE
1219 05C0' 07 LDN GPAGE
1220 05C1' CA 05E0' LBNZ ZINCN ; IF NOT; GO TO ZINCN
1221 ;
1222 ;ELSE:
1223 05C4' F8 94 ZINCO: LDI YZPOS ; CHECK CURRENT POSITION
1224 05C6' A7 PLO GPAGE
1225 05C7' 07 LDN GPAGE
1226 05C8' 23 DEC ASTK
1227 05C9' FA 07 ANI 07 ; MASK OUT UNUSED HI NIBBLE AND ZERO RESET BIT
1228 05CB' 5E STR ASTK ; STORE ON SEQUENCER ASTK
1229 05CC' FF 07 SMI 07
1230 05CE' C0 0619' LBDF POSXT2 ; IGNORE AND EXIT IF POSITION > "
1231 ;
1232 05D1' E2 SEX STACK ; SET UP INITIAL PARAMETERS
1233 ; SCAL R6, POS0
1234 05D2' 68 86 ;
1235 05D4' 0637' ;
1236 ;
1237 05D6' E2 SEX STACK ; PULSE Z+ RELAY to start
1238 ; SCAL R6, PULSE ; the traverse
1239 05D7' 68 86 ;
1240 05D9' 0736' ;
1241 05DB' 10 DB 34Q ; J2Q = Z+ Relay
1242 05DC' 14 DB 04H ; 100 mSec. Pulse

MACRO-18 3.36 PAGE 1-27
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1243 ;
1244 05DD' C0 0622' LBR POSXT1 ; EXIT THE ROUTINE
1245 ;
1246 ;
1247 05E0' E1 ZINCN: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
1248 05E1' 61 OUT GROUP ;GROUP 00
1249 05E2' 00 DB 00
1250 05E3' F8 94 LDI YZPOS
1251 05E5' A7 PLO GPAGE
1252 05E6' 57 SEX GPAGE
1253 05E7' 6C INP YZ ;INPUT Z POSITION
1254 05E8' FA 07 ANI 07H ;Mask null bits "0" position bit
1255 05EA' E2 SEX STACK
1256 05EB' 52 STR STACK
1257 05EC' 0E LDN ASTK ;GET THE ORIGIONAL Z VALUE FOR THE ASTK
1258 05ED' FC 01 ADI 01
1259 05EF' F3 XOR ;(Z POS) XOR (OLD POS + 1)
1260 05F0' C2 0612' LBZ ZINCOK ;IF AT NEXT POSITION, GO TO ZINCOK
1261 ; ;IF NOT:
1262 05F3' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
1263 05F5' A7 PLO GPAGE ; AT CYCLES= 01
1264 05F6' 07 LDN GPAGE
1265 05F7' F3 J1 XRI 01
1266 05F9' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
1267 05FC' F8 68 LDI PPCCNT ; INC PPCCNT
1268 05FD' A7 PLO GPAGE
1269 05FF' 07 LDN GPAGE
1270 0600' FC J1 ADI 01
1271 0602' 57 STR GPAGE
1272 0603' F3 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
1273 0605' CA 0622' LBNZ POSXT1 ; THEN EXIT
1274 ;
1275 ;
1276 0608' E2 ZINCER: SEX STACK ;PULSE Z+ RELAY TO STOP TRAVERSE
1277 SCAL R6, PULSE
1278 0609' 68 36 +
1279 0603' 0736' +
1280 060D' 1C DB 34Q
1281 0602' 08 DB 08H
1282 060F' C0 0625' LBR POSERR
1283 ;
1284 0612' E2 ZINCOK: SEX STACK ;PULSE Z+ RELAY TO STOP TRAVERSE
1285 SCAL R6, PULSE
1286 0613' 68 36 +
1287 0615' 0736' +
1288 0617' 1C DB 34Q

MACRO-18 3.36 PAGE 1-23
SEADUCT EXT SEQUENCER: SD35R9.MAC 22 SEP 86

1239 0618' 08 DB, 08H
1290 ;
1291 0619' E2 POSOK: SEX STACK
1292 ; SCAL R6, POS1 ;CLEAR PARAMETERS
1293 061A' 68 36
1294 061C' 0650' ;
1295 ;
1296 061E' 1E POSXT2: INC ASTK ;CLEAR OLD ZPOS FROM ASTK
1297 061F' C0 0000* LBR INCPPC ;GO TO SET UP FOR NEXT PPC
1298 ;
1299 ;
1300 0622' C0 0000* POSXT1: LBR DECPPC ;GO TO DECREMENT PPC
1301 ;
1302 ;
1303 0625' F8 80 POSERR: LDI ERROR ;SET POSITION ERROR CODE IN ERROR WORD
1304 0627' A7 PLO GPAGE
1305 0628' 07 LDN GPAGE
1306 0629' F9 30 ORI 80H ;POSITION ERROR = BIT 7
1307 062B' 57 STR GPAGE
1308 ;
1309 062C' 32 SEX STACK ;CLEAR PARAMETERS
1310 ; SCAL R6, POS1
1311 062D' 68 36 ;
1312 062F' 0650' ;
1313 ;
1314 0631' F8 CA LDI 0AH ;LOAD ASTK WITH ERROR CODE (Stk position is
1315 0633' 5E STR ASTK ;not changed; pinger will clear and increment)
1316 0634' C0 0123' LBR PINGRX ;SEND PINGER XYZ ERROR CODE ("A")
1317 ;
1318 ;
1319 ;
1320 ;*** SUBROUTINES ***
1321 ;
1322 0637' F8 34 POS0: LDI XYZFLG ; SET XYZ FLAG = AC FOR THIS SEQUENCE
1323 0639' A7 PLO GPAGE ; (TURNS ON OPTO INTERRUPTER PWR)
1324 063A' F8 AC LDI 0ACH
1325 063C' 57 STR GPAGE
1326 ;
1327 063D' F8 30 LDI ERROR ; SET ERROR WORD MSB = 0
1328 063F' A7 PLO GPAGE
1329 0640' 07 LDN GPAGE
1330 0641' FA 7F ANI 7FH
1331 0643' 57 STR GPAGE
1332 ;
1333 0644' F8 68 LDI PPCCNT ; SET PPCCNT TO 01
1334 0646' A7 PLO GPAGE

MACRO-18 3.36 PAGE 1-29
 SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

```

1335 0647' F8 01           LDI 01
1336 0649' 57              STR GPAGE
1337 ; 
1338 064A' 27              DEC GPAGE ; SET SEQROT TO RUN EVERY CYCLE
1339 064B' F8 10            LDI 10H ; (EVERY 25 mSEC.)
1340 064D' 57              STR GPAGE
1341 ;
1342 ; 
1343 064E' 68 96            SRET R6 ; RETURN FROM SUBROUTINE
1344 ;
1345 ;
1346 0650' F8 68            POS1: LDI PPCNT ;CLEAR PPC COUNT
1347 0652' A7              PLO GPAGE
1348 0653' F8 00            LDI 00
1349 0655' 57              STR GPAGE
1350 ;
1351 0656' 27              DEC GPAGE ;CLEAR SEQUENCER RATE
1352 0657' 57              STR GPAGE
1353 ;
1354 0658' F8 34            LDI XYZFLG ;RESET XYZ FLAG = 00
1355 065A' A7              PLO GPAGE
1356 065B' F8 00            LDI 00
1357 065D' 57              STR GPAGE
1358 ;
1359 ; 
1360 065E' 68 96            SRET R6 ;RETURN FROM SUBROUTINE
1361 ;
1362 ;
1363 ;
1364 ;
1365 ;***** EO An - SEDIMENT AND WATER SAMPLE FUNCTIONS *****
1366 ; where n = 0-7
1367 ;
1368 0660' E2              SAM1X: SEX STACK ;EO A0-A3
1369 0661' 0C              LDN PPC
1370 0662' FA 03            ANI 03 ;MASK FOR LAST 2 BITS
1371 0664' C2 0000*          LBZ INCPPC ; EO A1 = DOES NOTHING
1372 0667' FB 01            XRI 01
1373 0669' 32 76'           BZ SED1I ; EO A1 = SED. I INSERT
1374 066B' FB 03            XRI (01 XOR 02)
1375 066D' 32 77'           BZ SED1R ; EO A2 = SED. I RETRACT
1376 066F' FB 01            XRI (02 XOR 03)
1377 0671' 32 38'           BZ SEDIU ; EO A3 = SED. I UNLATCH & H2O SAMPLE I
1378 0673' C0 0000*          LBR INCPPC
1379 ;
1380 ;
  
```

NACRO-18 3.36 PAGE 1-30
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1381	0676'		SED1I: SCAL R6, PULSE	;PULSE SED.1 INSERT RELAY
1382	0676'	68 86	+	
1383	0678'	0736'	+	
1384	067A'	06	DB 06Q	; Conn. 2 - Pin 3
1385	067B'	08	DB 08H	; Relay Pod 2
1386	067C'	C0 0000*	LBR INCPPC	
1387			;	
1388	067F'		SED1R: SCAL R6, PULSE	;PULSE SED.1 RETRACT RELAY
1389	067F'	68 86	+	
1390	0681'	0736'	+	
1391	0683'	07	DB 07Q	; Conn. 2 - Pin 7
1392	0684'	08	DB 08H	; Relay Pod 2
1393	0685'	C0 0000*	LBR INCPPC	
1394			;	
1395	0688'		SED1U: SCAL R6, PULSE	;PULSE SED.1 UNLATCH, H2O SAMPLE 1 RELAY
1396	0688'	68 86	+	
1397	068A'	0736'	+	
1398	068C'	08	DB 10Q	; Conn. 2 - Pin 6
1399	068D'	08	DB 08H	; Relay Pod 2
1400	068E'	C0 0000*	LBR INCPPC	
1401			;	
1402			;	
1403			;	
1404	0691'	E2	SAM2X: SEX STACK	;EO A4-A7
1405	0692'	0C	LDN PPC	
1406	0693'	FA 03	ANI 03	;MASK FOR LAST 2 BITS
1407	0695'	C2 0000*	LBZ INCPPC	; EO A4 = DOES NOTHING
1408	0698'	FB 01	XRI 01	
1409	069A'	32 A9'	BZ SED2I	; EO A5 = SED. 2 INSERT
1410	069C'	FB 03	XRI (01 XOR 02)	
1411	069E'	C2 06B2'	LBZ SED2R	; EO A6 = SED. 2 RETRACT
1412	06A1'	FB 01	XRI (02 XOR 03)	
1413	06A3'	C2 06BB'	LBZ SED2U	; EO A7 = SED. 2 UNLATCH
1414	06A6'	C0 0000*	LBR INCPPC	
1415			;	
1416			;	
1417	06A9'		SED2I: SCAL R6, PULSE	;PULSE SED.2 INSERT RELAY
1418	06A9'	68 86	+	
1419	06AB'	0736'	+	
1420	06AD'	09	DB 11Q	; Conn. 2 - Pin 5
1421	06AE'	08	DB 08H	; Relay Pod 2
1422	06AF'	C0 0000*	LBR INCPPC	
1423			;	
1424	06B2'		SED2R: SCAL R6, PULSE	;PULSE SED.2 RETRACT RELAY
1425	06B2'	68 86	+	
1426	06B4'	0736'	+	

MACRO-18 3.36 PAGE 1-31
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 66

1427 06B6' 0A DB 12Q ; Conn. 2 - Pin 4
1428 06B7' 08 DB 08H ; Relay Pod 2
1429 06B8' C0 0000* LBR INCPPC
1430 ;
1431 06B9' SED2U: SCAL R6, PULSE ;PULSE SED.2 UNLATCH, H2O SAMPLE 2 RELAY
1432 06B9' 68 86 +
1433 06BD' 0736' +
1434 06BF' 03 DB 13Q ; Conn. 2 - Pin 3
1435 06C0' 08 DB 08H ; Relay Pod 2
1436 06C1' C0 0000* LBR INCPPC
1437 ;
1438 ;
1439 ;
1440 ;***** EO A8-AB - HYDRAULIC, SUCTION PUMPS AND VIEW PORT CLEAN *****
1441 ;
1442 ;
1443 06C4' E2 PUMPX: SEX STACK
1444 06C5' 0C LDN PPC
1445 06C6' FA 03 ANI 03 ;MASK FOR LOW 2 BITS
1446 06C8' C2 06DD' LBZ HYDRU ; EO A8 = HYDRAULIC PUMP
1447 06CB' FB 01 XRI 01
1448 06CD' C2 06B6' LBZ SPARE1 ; EO A9 = SPARE #1
1449 06D0' FB 03 XRI (01 XOR 03)
1450 06D2' C2 06EF' LBZ SUCT ; EO AA = SUCTION PUMP
1451 06D5' FB 01 XRI (02 XOR 03)
1452 06D7' C2 06F8' LBZ CLEAN ; EO AB = CLEAN VIEW PORT
1453 06DA' C0 0000* LBR INCPPC
1454 ;
1455 06DD' HYDRU: SCAL R6, PULSE ;HYDRAULIC PUMP
1456 06DD' 68 86 +
1457 06DF' 07B6' +
1458 06E1' 13 DB 36Q ; Conn. 6 - Pin 3
1459 06E2' 08 DB 08H ; Relay Pod 6
1460 06E3' C0 0000* LBR INCPPC
1461 ;
1462 06E6' SPARE1: SCAL R6, PULSE ;SPARE #1
1463 06E6' 68 86 +
1464 06E8' 0736' +
1465 06EA' 21 DB 41Q ; Conn. 6 - Pin 3
1466 06EB' 08 DB 08H ; Relay Pod 6
1467 06EC' C0 0000* LBR INCPPC
1468 ;
1469 06EF' SUCT: SCAL R6, PULSE ;SUCTION PUMP
1470 06EF' 68 86 +
1471 06F1' 07B6' +
1472 06F3' 16 DB 26Q ; Conn. 4 - Pin 4

MACRO-18 3.36 PAGE 1-32
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 66

1473 06F4' 08 DB 08H ; Relay Pod 4
1474 06F5' C0 0000* LBR INCPPC
1475 ;
1476 06F8' 68 86 CLEAN: SCAL R6, PULSE ;CLEAN VIEW PORT
1477 06F8' +
1478 06FA' 0736' +
1479 06FC' 17 DB 27Q ; Conn. 4 - Pin 3
1480 06FD' 08 DB 08H ; Relay Pod 4
1481 06FE' C0 0000* LBR INCPPC
1482 ;
1483 ;
1484 ;***** EO AC-AF - Flume Insert and Withdraw; Recirculate Pumps *****
1485 ;
1486 0701' E2 PLUMX: SEX STACK
1487 0702' 0C LDW PPC
1488 0703' FA 03 ANI 03 ;MASK FOR LOW 2 BITS
1489 0705' C2 0715 LBZ INSRT ; EO AC = Insert Flume
1490 0708' FB 01 XRI 01
1491 070A' C2 071E' LBZ RETRAC ; EO AD = Retract Flume
1492 070D' FB 03 XRI (01 XOR 02)
1493 070F' C2 0727' LBZ PUMPR1 ; EO AE = Recirculate Pump #1
1494 ; XRI (02 XOR 03) ;***** EO AF DISABLED *****
1495 ; 3Z PUMPR2 ; 30 AF = Recirculate Pump #2
1496 0712' C0 0000* LBR INCPPC
1497 ;
1498 0715' INSRT: SCAL R6, PULSE ;Insert Flume
1499 0715' 68 86 +
1500 0717' 0736' -
1501 0719' 12 DB 22Q ; Conn. 4 - Pin 8
1502 071A' 08 DB 08H ; Relay Pod 4
1503 071B' C0 0000* LBR INCPPC
1504 ;
1505 071E' RETRAC: SCAL R6, PULSE ;Retract Flume
1506 071E' 68 36 +
1507 0720' 07B6' -
1508 0722' 13 DB 23Q ; Conn. 4 - Pin 7
1509 0723' 08 DB 08H ; Relay Pod 4
1510 0724' C0 0000* LBR INCPPC
1511 ;
1512 0727' PUMPR1: SCAL R6, PULSE ;RECURCULATE PUMP #1
1513 0727' 68 86 +
1514 0729' 07B6' -
1515 072B' 1F DB 37Q ; Conn. 6 - Pin 7
1516 072C' 08 DB 08H ; Relay Pod 6
1517 072D' C0 0000* LBR INCPPC
1518 ;

MACRO-18 3.36 PAGE 1-33
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1519 :PUMPR2: SCAL R6, PULSE ;RECURCULATE PUMP #2
1520 ; DB 40Q ; Conn. 6 - Pin 6
1521 ; DB 08R ; Relay Pod 6
1522 ; LBR INCPPC
1523 ;
1524 ;
1525 ;
1526 ;***** EO CO - TAKE A PICTURE *****
1527 ;
1528 0730' OC FLASHX: LDN PPC ;DECODE PPC
1529 0731' FA 03 ANI 03
1530 0733' CA 0000* LBNZ INCPPC ;RETURN IF NOT CO
1531 ;
1532 0736' E1 SEX INTPC
1533 0737' 61 OUT GROUP ; SELECT I/O GROUP 0
1534 0738' 00 DB 00
1535 ;
1536 0739' 66 OUT CAMERA ; I/O 6
1537 073A' 00 DB 00 ; NULL DATA
1538 ;
1539 073B' F8 38 LD1 CAMCNT ;INCREMENT CAMERA FRAME COUNTER
1540 073D' A7 PLO GPAGE
1541 073E' 07 LDN GPAGE
1542 073F' FC 01 ADI 01H
1543 0741' 57 STR GPAGE
1544 ;
1545 0742' CO 0000* LBR INCPPC
1546 ;
1547 ;
1548 ;
1549 ;***** EO DO - RESET THE LDV *****
1550 ;
1551 0745' OC RDVX: LDN PPC ;DECODE PPC
1552 0746' FA 03 ANI 03
1553 0748' CA 0000* LBNZ INCPPC ;RETURN IF NOT DO
1554 ;
1555 074B' E1 SEX INTPC ;SELECT I/O GROUP 0
1556 074C' 61 OUT GROUP
1557 074D' 00 DB 00
1558 ;
1559 074E' 65 OUT LDVRST ;RESET LDV (I/O 5)
1560 074F' 00 DB 00 ; NULL DATA
1561 ;
1562 ;
1563 0750' CO 0000* LBR INCPPC
1564 ;

MACRO-18 3.36 PAGE 1-34
SEADUCT EXT SEQUENCER: SDB5R9.MAC 22 SEP 86

1565 ;
1566 ;
1567 ;***** EO Fn aaaa - SEQUENCER BRANCH ON SWITCH *****
1568 ; ***** n = 0-3, aaaa = Branch address
1569 ; ***** F0 = Bottom Switch, F1 = Flume Insertion Switches,
1570 ; ***** F2 = Flume Retracted Switch, F3 = IGNORED (Spare)
1571 ;
1572 ; ***** SWSTAT = : Bot | ____| Ins0 || Ins4 | Ins3 | Ins2 | Ins1 | *****
1573 ;
1574 ;
1575 0753' F8 82 IFSWX: LDI SWSTAT ; IF SWITCH nn FUNCTIONS
1576 0755' A7 PLO GPAGE ; LOAD SWITCH STATUS
1577 0756' 0C LDN PPC
1578 0757' FA 03 ANI 03 ; DO: IF PPC =
1579 0759' C2 076C' LBZ IFBOT ; EO F0, GO TO BOTTOM SW. ROUTINE
1580 075C' FB 01 XRI 01 ;
1581 075E' C2 0774' LBZ IFINS ; EO F1, GO TO FLUME INSERTION SW ROUTINE
1582 0761' FB 03 XRI (01 XOR 02) ;
1583 0763' C2 077F' LBZ IFRETR ; EO F2, GO TO FLUME RETRACTED SW ROUTINE (Ins0)
1584 ;
1585 0766' 1C IFSWXT: INC PPC ; OTHERWISE, EXIT
1586 0767' 1C INC PPC
1587 0768' 1C INC PPC
1588 0769' C0 0000* LBR SAVPPC
1589 ;
1590 076C' 07 IFBOT: LDN GPAGE ; IF BOTTOM SW, JUMP TO AAAA
1591 076D' FE SHL ; ELSE, EXIT
1592 076E' C3 0766' LBNF IFSWXT
1593 0771' C0 0000* LBR JUMP
1594 ;
1595 0774' 07 IFINS: LDN GPAGE ; IF ALL 4 INSERTION SWITCHES, JUMP TO AAAA
1596 0775' FA 0F ANI 0FH ; ELSE, EXIT
1597 0777' FB 0F XRI 0FH
1598 0779' C2 0000* LBZ JUMP
1599 077C' C0 0766' LBR IFSWXT
1600 ;
1601 077F' 07 IFRETR: LDN GPAGE ; IF FLUME IS RETRACTED, JUMP TO AAAA
1602 0780' FA 10 ANI 10H
1603 0782' C2 0766' LBZ IFSWXT
1604 0785' C0 0000* LBR JUMP
1605 ;
1606 ;
1607 ;
1608 ;***** EO Fn aaaa - SEQUENCER BRANCH ON ACOUSTIC SIGNAL *****
1609 ; ***** n = 8-B, aaaa = Branch address
1610 ; ***** F8 = Sig. A, F9 = Sig. B, FA = Sig. C, FJ = IGNORED *****

MACRO-18 3.36 PAGE 1-35
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 86

1611 ;
1612 ; ***** ACSTAT = | | | | | | | Sig.C | Sig.B | Sig.A | *****
1613 ;
1614 ;
1615 0788' F8 81 IFACUX: LDI ACSTAT
1616 078A' A7 PLO GPAGE
1617 078B' 0C LDN PPC
1618 078C' FA 03 ANI 03
1619 078E' C2 07A1' LBZ IFACA ;EO F8
1620 0791' FB 01 XRI 01
1621 0793' C2 07A6' LBZ IFACB ;EO F9
1622 0796' FB 03 XRI (01 XOR 02)
1623 0798' C2 07AB' LBZ IFACC ;EO FA
1624 ;
1625 079B' 1C IFACXT: INC PPC ;IF NO SIGNAL, CONTINUE W/O JUMP
1626 079C' 1C INC PPC
1627 079D' 1C INC PPC
1628 079E' C0 0000* LBR SAVPPC
1629 ;
1630 07A1' 07 IFACA: LDN GPAGE ;IF SIGNAL A
1631 07A2' FA 01 ANI 01
1632 07A4' 30 30' BR IFAC?
1633 ;
1634 07A6' 07 IFACB: LDN GPAGE ;IF SIGNAL B
1635 07A7' FA 02 ANI 02
1636 07A9' 30 30' BR IFAC?
1637 ;
1638 07AB' 07 IFACC: LDN GPAGE ;IF SIGNAL C
1639 07AC' FA 04 ANI 04
1640 07AE' 30 30' BR IFAC?
1641 ;
1642 07B0' CA 0000* IFAC?: LBNZ JUMP ;JUMP TO aaaa IF SIGNAL
1643 07B3' C0 0793' LBR IFACXT ;IF NOT, GO TO NEXT PPC
1644 ;
1645 ;
1646 ;
1647 ;***** 200 mSEC. RELAY PULSE SUBROUTINE *****
1648 ;
1649 07B6' F8 42 PULSE: LDI PULNUM
1650 07B8' A7 PLO GPAGE
1651 07B9' 46 LDA LIST ;Get Relay Driver # from LIST
1652 07BA' E7 SEX GPAGE
1653 07BB' 73 STXD ;Store Relay Driver # at GPAGE = PULNUM
1654 07BC' 46 LDA LIST ;Get Pulse time from LIST (time = 25mSec X LIST)
1655 07BD' 73 STXD ;Set Pulse time counter
1656 07BE' F8 AC LDI OACH

MACRO-18 3.36 PAGE S
SEADUCT EXT SEQUENCER: SDE5R9.MAC 22 SEP 36

MACROS:

SCI	BXI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSMB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSKD	SCAL	SCN1	SCN2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRET	XID	XIE

SYMBOLS:

ACSTAT	0081	AD5H8	0091	AD5L4	0092	ADFLG	00B0
ADGH8	008D	ADGL4	008E	ADH18	0003	ADL04	0002
ADON	0030	ADRH8	008F	ADRL4	0090	ADT0H8	00A7
ADT0L4	00A8	ADT1H8	0095	ADT1L4	0096	ADT2H8	0097
ADT2L4	0098	ADT3H8	0099	ADT3L4	009A	ADT4H8	0098
ADT4L4	009C	ADT5H8	009D	ADT5L4	009E	ADT6H8	009F
ADT6L4	00A0	ADT7H8	00A1	ADT7L4	00A2	ADT8H8	00A3
ADT8L4	00A4	ADT9H8	00A5	ADT9L4	00A6	ARI	001C
AR10	001B	AR100	001A	ARFLG	001D	ASTK	000E
ASTKHI	0064	ASTKLO	0065	ASTKTP	527F	ATFLG	001E
ATMFLG	001F	BAT1	0002	BAT2	0003	BAT3	0004
BATT	0100	BATT1	0114	BATT2	0118	BATT3	011C
BATTRY	0010	BATTSY	008C	BATTUP	008B	BATXTT	0130
BLT	0000	BR2CNT	007D	BUF9	0020	BUFFER	5B00
BUFPG	005B	CAMCNT	0088	CAMERA	0006	CLEAN	06F8
CMPASS	0002	CMPSS	0064	CNTRL1	0003	CNTRL2	0005
CNTRL3	0007	CRCHI	0006	CRCLO	0007	CRGRAM	0005
CTAHI	006C	CTALO	006D	CTAVHI	006E	CTAVLO	006F
CTBHI	0070	CTBLO	0071	CTBVHI	0072	CTBVLO	0073
CTCHI	0074	CTCL0	0075	CTCVHI	0076	CTCVLO	0077
CYCCNT	0008	CYCLES	0019	D1	0012	D10	0011
D100	0010	DATA1	0002	DATA2	0004	DATA3	0006
DECPPC	0623*	DMA	0000	DONE	00FF	ERROR	0080
ETX	0003	EXPNUM	000F	EXTE0	0000	FLAGA	0069
FLAGB	006A	FLAGC	006B	FLASH	00C0	FLASHX	0730
FLUM	00AC	FLUMX	0701	FORMT1	0012	GLOPG	0050
GP	5000	GPAGE	0007	GROUP	0001	GRPSAV	000A
H1	0014	H10	0013	HALT	0006	HDG	0085
HDGZXP	00BF	HDGFLG	00B3	HDGIN	02AA*	HDGPWR	0005
HDGVAL	0020	HEADNG	0004	HLATCH	0003	HSHIFT	0004
HYDRO	06DD	HZ	0028	IFAC?	0730	IFACA	07A1
IFACB	07A6	IFACC	07AB	IFACU	00F8	IFACUX	0788
IFACXT	0793	IFBOT	076C	IFINS	0774	IFRETR	077F
IFSW	00F0	IPSWX	0753	IPSWXT	0766	INCPPC	0751*
INSRT	0715	INTCRL	7840	INTMSK	F800	INTPC	0001
INTPG	00F8	INTPOL	7840	INTSTA	F800	INTVEC	F880
ICA	0006	IOCLR	0004	IOCTEL	0005	IOLOC	00FE
ICSTAT	0005	JUMP	07B1	L2BUF	00C0	LDVRST	0005
LIST	0006	M1	0016	X10	0013	MEMORY	0007
MEMPTR	00AE	MUX	0002	MUXPTR	00AD	NULL	00AF
PC	0003	PDSTAT	0081	PING	0007	PINGR	0024

MACRO-18 J.36 PAGE S-1
SEADUCT EXT SEQUENCER: SD35R9.MAC 22 SEP 86

PINGRX	0123'	PITCH	0089	PLEVEL	0002	PMPS	0060'
PMPS0	0135'	PMPS1	01AF'	PMPS2	01AE'	PMPSPD	0006
PMPSX	019B'	PMTCHR	003A	PNGAGN	0137'	PNGCY1	0164'
PNGCY2	0180'	PNGCY3	0189'	PNGCY4	0192'	PNGCY5	0152'
PNGXT1	016C'	PNGXT2	016F'	PORTB	0007	POSO	0637'
POS1	0650'	POSERR	0625'	POSOK	0619'	POSX	0342'
POSXT1	0622'	POSXT2	061E'	POSXY	0098'	POSZ	009C'
PPC	000C	PPCCNT	0068	PPCHI	0060	PPCLO	0061
PULCNT	0041	PULFLG	0040	PULNUM	0042	PULSE	07B6'
PULXN	038C'	PULXP	0383'	PULYN	039E'	PULYP	0395'
PULZN	03B0'	PULZP	03A7'	PUMP	00A8'	PUMP1	0086
PUMP2	0087	PUMPR1	0727'	PUMPX	06C4'	RBHI	0008
RBLO	0009	RCCW	022B'	RCNT	0326'	RCNTX1	033B'
RCNTX2	033D'	RCW	0223'	RECFLG	0082	RELAYS	0007
RETRAC	071E'	RLDV	00D0'	RLDVX	0745'	ROLL	008A
ROT	0080'	ROTO	02FD'	ROTOO	023A'	ROTOER	0269'
ROTON	0254'	ROTOOK	0273'	ROT1	0316'	ROTCO	02D7'
ROTCOR	02D1'	ROTERR	02EB'	ROTHO	0283'	ROTH?	028E'
ROTHDG	027D'	ROTHER	02BD'	ROTHN	02A7'	ROTHOK	02C7'
ROTOK	02DF'	ROTRTN	0233'	ROTX	01FD'	ROTXT	0220'
ROXTX1	02E8'	ROXTX2	02E4'	RSTK	000D	RSTKHI	0062
RSTKLO	0063	RSTKTP	523F	RTNPTR	0006	RTTY2	000F
SAM1	00A0'	SAM1X	0660'	SAM2	00A4'	SAM2X	0691'
SAVPPC	079F*	SDLNGT	0029	SDGN	0050'	SDREQ	0003
SZC1	0018	SEC10	0017	SED1I	0676'	SED1R	067F'
SED1U	0688'	SED2I	06A9'	SED2R	06B2'	SED2U	06B3'
SEQFAS	0066	SEQRAT	0067	SETCLR	0053*	SPARE1	06E6'
SSTKPG	0052	STACK	0002	STAT1	0003	STAT2	0005
STAT3	0007	STKEND	53DF	STKPG	0053	SUCT	06EF'
SWITCH	0002	SWSTAT	0082	SYSFLG	0003	SYSTEM	0007
TILER	01F0'	TILT	0070'	TILTOK	01E3'	TILTX	01BD'
TIME01	003C	TIME02	00F0	TLEVEL	005A	TLIMIT	0006
TRFLG	00B1	TRON	0040'	TTY2HI	007E	TTY2LO	007F
UARTS	0006	X	0003	X0	03B9'	X00	03C8'
XOERR	0406'	XON	03E4'	XOOK	0410'	XINC	041A'
XINCO	042A'	XINCER	0463'	XINCN	0446'	XINCK	0473'
XPOS	0093	XY	0090'	XYZFLG	0084	YO	0482'
Y00	0492'	YCER	04C3'	YCN	04AD'	YOOK	04D8'
YINC	04E2'	YINCG	04F2'	YINCER	053E'	YINCN	0512'
YINCK	0548'	YZ	0004	YZPOS	0094	Z	0094'
Z0	0552'	Z00	0562'	Z0ERR	05A0'	Z0N	057E'
ZOOK	05AA'	ZINC	05B4'	ZINCO	05C4'	ZINCER	0608'
ZINCN	05E0'	ZINCK	0612'				

NO FATAL ERROR(S)

BATT2	191	200\$
BATT3	193	204\$
BATTRY	75\$	
BATTSY	44\$	
BATTUP	44\$	
BATTXT	194	198 202 206 208\$
BCI	28\$	
BLT	44\$	
BR2CNT	44\$	
BUFF9	44\$	
BUFFER	44\$	
BUFPG	44\$	44
BXI	28\$	
CALL	28\$	
CAMCNT	44\$	1539
CAMERA	44\$	1536
CID	28\$	
CIE	28\$	
CLEAN	1452	1476\$
CMPASS	44\$	
CMPSS	44\$	510
CNTRL1	44\$	
CNTRL2	44\$	
CNTRL3	44\$	
CRCHI	44\$	
CRCHO	44\$	
CRCRM	44\$	
CTABI	44\$	
CTALO	44\$	
CTAVHI	44\$	
CTAVLO	44\$	
CTBHI	44\$	
CTBLO	44\$	
CTBVHI	44\$	
CTBVLO	44\$	
CTCHI	44\$	
CTCLO	44\$	
CTCVHI	44\$	
CTCVLO	44\$	
CYCCNT	44\$	
CYCLES	44\$	236 582 332 919 999 1094 1174 1262
D1	44\$	
D10	44\$	
D100	44\$	
DACI	28\$	
DADC	28\$	
DADD	28\$	
DADI	28\$	
DATA1	44\$	

ROTHN	507	545\$	592										
ROTHOK	559	578\$											
ROTK	498	584	607\$										
ROTRTN	406	432\$											
ROTX	112	115	394\$										
ROTXT	411\$	419	427										
ROTXT1	460	480	542	567	616\$								
ROTXT2	446	525	528	612\$									
RSTK		44\$											
RSTKHI		44\$											
RSTKLO		44\$											
RSTKTP		44\$											
RSXD		38\$											
RTNPTR		44\$											
RTTY2		44\$											
SAM1		136\$											
SAMIX		136	1368\$										
SAM2		140\$											
SAMZX		140	1404\$										
SAVPPC		60\$	1588	1628									
SCAL		28\$	414	422	449	454	464	476	484	493	532	537	546
		563	571	579	608	625	740	747	754	761	768	775	808
		813	847	856	890	895	934	942	975	980	1014	1023	1061
		1066	1109	1117	1150	1155	1190	1199	1233	1238	1277	1285	1292
		1310	1381	1388	1395	1417	1424	1431	1455	1462	1469	1476	1498
		1505	1512										
SCM1		28\$											
SCM2		28\$											
SDLNGT		44\$											
SDON		99\$											
SDREQ		44\$											
SEC1		44\$											
SEC10		44\$											
SED1I		1373	1381\$										
SED1R		1375	1388\$										
SED1U		1377	1395\$										
SED2I		1409	1417\$										
SED2R		1411	1424\$										
SED2U		1413	1431\$										
SEQFAS		44\$											
SEQRAT		44\$	266	276	346	394	786	368	353	1035	1128	1211	
SETCLR		60\$	90	95	100								
SPARE1		1448	1462\$										
SPM1		28\$											
SPM2		28\$											
SRET		28\$	657	675	700	706	1342	1359	1659				
SSTKPG		44\$	44	44									
STACK		44\$	448	453	463	475	483	492	531	536	545	562	570
		578	607	624	712	807	812	846	855	889	894	912	913

YON	962	989#
YOOK	997	1022#
YINC	733	1035#
YINCO	1047#	
YINCER	1108#	
YINCN	1044	1075#
YINCOK	1092	1116#
YZ	44#	995 1081 1170 1253
YZPOS	44#	965 992 1047 1078 1140 1167 1223 1250
Z	124#	
ZO	735	1128#
ZOO	1140#	
ZOERR	1189#	
ZON	1137	1164#
ZOOK	1172	1198#
ZINC	737	1211#
ZINCO	1223#	
ZINCER	1276#	
ZINCN	1220	1247#
ZINCOK	1260	1284#

APPENDIX D

HXRCA - Intel .HEX file format to .RCA file format conversion.

The following BASIC program converts Intel HEX format object code files created by the Syscon assembler - linker to RCA file format. In this version, the HEX file resides on a ram disk called drive M. This must be changed for use in other systems. The M drive is specified on lines 40 and 80 of the program.

```
10 'Program to read .HEX file from the M: drive and write a .RCA file.
20 'W. Terry, A. Bradley - 1986
30 'This section selects input file
40 G$="M:.*.*"
50 FILES G$
60 PRINT"FILE TO READ? (must be M:nnnnnn.HEX, just input without extension)"
70 INPUT FS
80 F$="M:"+FS
90 PRINT F$+".HEX";" OK?";:INPUT Y$
100 IF Y$<>"Y" GOTO 60
110 '
120 'Now open the .HEX and .RCA files
130 OPEN "I",#1,F$+".HEX"
140 OPEN "O",#2,F$+".RCA"
150 R$="!M "
160 '
170 'Read a line at a time and translate
180 INPUT#1, LS 'get Intel line
190 L=LEN(L$)
200 NS=MIDS(L$,2,2) 'get length in hex
210 HS=NS:GOSUB 500 'convert HEX byte to DEC
220 IF H=0 GOTO 280
230 PRINT#2, RS+";"
240 A$=MIDS(L$,4,4)
250 D$=MIDS(L$,10,2*H)
260 RS=A$+" "+D$
270 GOTO 170
280 ' Print final line
290 PRINT#2, RS
300 RESET 'close disk files
310 SYSTEM
320 STOP
330 '
500 ' Convert HS in hex to H in dec.
510 ' Convert HS in hex to H in dec
520 H=ASC(RIGHTS(HS,1))-48
530 IF H>9 THEN H=H-7
540 H1=ASC(LEFTS(HS,1))-48
550 IF H1>9 THEN H1=H1-7
560 H=H+16*H1
570 RETURN
```

Appendix E

Sea Duct Monitor Cyclic Redundancy Check (CRC)

Calculation of a CRC checksum over a block of memory is reputed to be the remainder from a division. The entire data block is divided by a special 16 bit constant and the CRC is the remainder. The constant is chosen such that the probability of a random change in the data block giving the same CRC value is minimal.

The procedure is as follows:

1. Set the 16 bit CRC variable to zero.
2. Call the CRC subroutine and give it the first byte of the data block. The subroutine will modify the CRC.
3. Call the CRC subroutine again, this time passing it the next data byte. Repeat this until you have given it all the bytes in the block.
4. The final CRC is now valid for the data block.

The CRC subroutine

Variable use:

B = data byte passed in the call
CH = high byte of the 16 bit CRC
CL = low byte of the 16 bit CRC
S = a scratch byte

1. S = B XOR CH :Constants shown base 16
2. S = (S/16) XOR S :Integer arithmetic
3. CH= CL XOR ((S*16) mod 256) :mod 256 arithmetic
4. CH= CH XOR (S/8)
5. CL= S XOR ((S*32) mod 256)
- R. Return from subroutine

Notice that this can be done easily in 8 bit machine code using logical shifts and XOR.

Debug Test: The CRC over a string of 0 bytes stays 0. The CRC over the four bytes 11 22 33 44 is DD33. The CRC over the string 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F is 513D.

Appendix F

Radio Shack TRS-80 Model 100 Communication with SAIL and MCALL

To use the Radio Shack Mod.100 with MCALL:

Set MCALL to:

Echoplex, 2400 Baud, X-ON/X-OFF,
7 Data, Even Parity, 1 Stop bit

For two way communication:

Get the M-100 running in TELCOM,
M-100 status = 67E1D, Half Duplex

To send a file to the M-100:

Set the M-100 to half duplex (see above)
Enter the text mode for a new file and name the new file.
To replace an existing file, enter the text mode by
running the file name, then clear the file.

MCALL - Use (esc.)F to name the file to send.

M100 - Use "LOAD" - Load from COM:67E1D

MCALL - Use (esc.)T to send

To send a file to MCALL:

Set the M-100 to half duplex (see above)
Enter the text mode by running the file name.
MCALL - Use (esc.)F name the file to receive.
MCALL - Use (esc.)R to receive the file.
M100 - Use "SAVE" - Save to COM:67E1D

To use the Radio Shack M-100 with SAIL:

(Assumes 300 Baud, 7 data, Even Par., 1 Stop, RCA format):

For two way communication:

Get the M-100 running in TELCOM,
M-100 status = 37E1D, Full Duplex

To send a file to a SAIL instrument:

Set the M-100 to full duplex (see above)
Enter the text mode by running the file name.
M100 - Use "SAVE" - Save to COM:67E1D
(Assumes a !M; at the start of the file.)

Appendix G

Electrochem Lithium Battery Warning

The page copied below is included with the Lithium batteries supplied by Electrochem Industries, Inc. These batteries are used in the microprocessor and emergency hydrostatic release systems.

Electrochem Industries Inc
9930 Wehrle Drive
Clarence, New York 14031
716-759-2828

TLX 91-386



LITHIUM BATTERY

WARNING: FIRE, EXPLOSION AND SEVERE BURN HAZARD.
DO NOT SHORT CIRCUIT, CHARGE, FORCE OVER-DISCHARGE,
DISASSEMBLE, CRUSH, PENETRATE, INCINERATE, HEAT
ABOVE 72° C (162° F), OR BATTERY MAY LEAK OR EXPLODE

CELLS MAY BECOME SHORT CIRCUITED BY ALLOWING A CONDUCTIVE
(METALLIC, ETC.) MATERIAL TO COME IN CONTACT WITH THE LEADS.

CELLS MAY SWELL AND LEAK WHEN OPERATED AT BOTH MAXIMUM
RATED CURRENT AND MAXIMUM RATED TEMPERATURE.

FORM NO. 3-3000/0683
REV. B

Appendix H
Sea Duct Pump Controller Program Listing

2500 A.D. 6301 CROSS ASSEMBLER - VERSION 3.01g

INPUT FILENAME : SDPUMP1.ASM
OUTPUT FILENAME : SDPUMP1.OBJ

```
1           TITLE SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER
2           SUBTITLE
3           :
4           :      A. Bradley, W. Terry
5           :
6           : Rev. 24 MAR 86 X COMMAND CLEARS REGISTERS.
7           : 06 MAR 86 First version.
8           :
9           :      SAIL portion interrupt driven by SCI
10          : PARITY SEEMS TO WORK, BUT THE ?MF000 1000 SEEMS TO
11          : HANG WITH THE MAC AT 9600, GET BETTER TERMINAL?
12          :
13          :
14          RADIX  H      :SET HEX DEFAULT
15 0000      CODE
16          ABSOLUTE
17          :
18          :
19          :
20 00 00      DDR1:     EQU    0
21 00 01      DDR2:     EQU    1
22 00 02      PORT1:    EQU    2      : !brk.x.x.x!x.x.P2 . P1!
23          :           : !flg.      .ecl.ebl!
24          :
25 00 03      PORT2:    EQU    3      : !X.X.X!SDO.SDI.SCK!TOUT.TIN!
26          :           : !mode ! serial   : timer !
27 00 04      DDR3:     EQU    4
28 00 05      DDR4:     EQU    5
29 00 06      PORT3:    EQU    6      : pump 1 power control
30 00 07      PORT4:    EQU    7      : pump 2 power control
31 00 08      TCSR:     EQU    8      : !ICP.OCF.TOF!SICI.BCCL.BTCI!IEDG.CLEV.
32          :           : ! int flags ! int masks   , in out
33 00 09      COUNTHI:  EQU    9      : Counter HI (1st)
34 00 0A      COUNTLO:  EQU    A      :           LO (2nd)
35 00 0B      COMPARHI: EQU    B      : Out compare HI
36 00 0C      COMPARLO: EQU    C      :           LO
37 00 0D      CAPTURHI: EQU    D      : Input Capture HI
38 00 0E      CAPTURLO: EQU    E      :           LO
39 00 0F      P3CSR:    EQU    F      :PORT3 C/S REG
40 00 10      TRMCR:    EQU    10     :XPR RATE & MODE CONTROL
41          :           : !x.x.x.x!CC1.CCO.SS1.SSO!
42 00 11      TRCSR:    EQU    11     :T/R CONTROL & STATUS REG
43          :           : !RDRP.CRFE.TDRE.RIE.RE.TIE.TE.WU!
44 00 12      RECD:     EQU    12     :REC'D DATA
45 00 13      XDATA:    EQU    13     :XMIT DATA
46 00 14      RANCOM:   EQU    14     : !STDBY PWR.RANE.x.x.x.x!
47          :
48          :-----: SAIL interface RAM workspace
```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

49    00 80      RJUMP:     EQU   $80    :JUMP INST GOES HERE..
50    00 81      RVECT:    EQU   $81    :      HI
51    :           EQU   $82    :      LO
52    00 83      XJUMP:    EQU   $83    :XMIT JUMP INST
53    00 84      XVECT:    EQU   $84    :      HI
54    :           EQU   $85    :      LO
55    00 86      JUMP2:    EQU   $86    :2ND JUMP INST
56    00 87      VECT2:    EQU   $87    :      HI
57    :           EQU   $88    :      LO
58    00 89      SCRATCH1: EQU   $89    :SCRATCH LOC 1
59    00 8A      SCRATCH2: EQU   $8A    :SCRATCH LOC 2
60    00 8B      SCRATCH3: EQU   $8B    :SCRATCH LOC 3
61    00 8C      SCRATCH4: EQU   $8C    :SCRATCH LOC 4
62    00 8D      SCRATCH5: EQU   $8D    :SCRATCH LOC 5
63    :
64    00 8E      BMODE:    EQU   $8E    :SAIL BREAK MODE
65    :           EQU   $8F    :!brk.x.x.x!x.x.x.x!
66    :           EQU   $8F    :flg.
67    00 8F      STATUS:   EQU   $8F    :REPLY STATUS
68    :
69    : general workspace
70    :
71    00 90      PUMP:    EQU   $90    :PUMP ADDRESS
72    :           EQU   $91    :
73    :
74    ****
75    :
76    F000          ORG   $F000  :ASSUME 32K EPROM
77    : SAIL Address stored here..
78    F000 23 50 43  ADDR: DB   '#PC'  :SAIL ADDRESS
79    F003 00          DB   $00    :TERMINATOR
80    F004 00 00 00 00  DB   $00,$00,$00,$00 :SPACE FOR LONG ADDRESS..
81    :
82    :
83    F008 8E 00 FF  START: LDS   #$00FF :SET STACK POINTER
84    F008 86 7F      LDAA  #$7F  :PREPARE PORT 1
85    F00D 97 00      STAA  DDR1  :AS OUTPUT WITH MSB AS BREAK DETECT
86    F00F 86 00      LDAA  #$00  :AND DISABLE PUMPS
87    F011 86 12      LDAA  #$12  :PREPARE PORT 2
88    F013 97 01      STAA  DDR2  :FOR FUTURE TIMER USE
89    F015 86 FF      LDAA  #$FF  :PREPARE PORT 3
90    F017 97 04      STAA  DDR3  :AS PUMP 1 CONTROL
91    F019 7F 00 06  CLR   PORT3  :AND CLEAR
92    F01C 86 FF      LDAA  #$FF  :PREP PORT 4
93    F01E 97 05      STAA  DDR4  :AS PUMP 2 CONTROL
94    F020 7F 00 07  CLR   PORT4  :AND CLEAR
95    :
96    F023 7F 00 89  CLR   SCRATCH1 :USE AS SAIL MODE FLAG & ADDR POINTER
97    F026 86 7E      LDAA  #$7E  :MUST WRITE JMP INSTS.
98    F028 97 80      STAA  RJUMP  :FOR SAIL DRIVER
99    F02A 97 83      STAA  XJUMP
100   F02C 97 86      STAA  JUMP2
101   F02E CC F9 78  LDD   #SETUPAD :SET VECTORS TO INITIAL VALUES
102   F031 DD 81      STD   RVECT
103   F033 DD 84      STD   XVECT
104   :
105   F035 86 04      LDAA  #$04  :ENABLE ETOI (TIMER OVERFLOW INTERRUPT)

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

106 F037 97 08      STAA   TCSR
107 F039 86 0C      LDAA   #SOC    :EXTERNAL CLOCK
108 F03B 97 10      STAA   TRMCR
109 F03D 86 1A      LDAA   #S1A    : SET RE TE RIE TO INIT SERIAL &
110 F03F 97 11      STAA   TRCSR   :ALLOW SERIAL INTERRUPTS FOR REC NOW
111          :
112 F041 86 2A      LDAA   #'*'
113 F043 97 8F      STAA   STATUS  :INITIALIZE STATUS
114 F045 7F 00 8E    CLR    BMODE   :AND MODE FLAG
115          :
116 F048 0E          CLI    :AND ALLOW INTERRUPTS
117 F049 1A          DOZE   SLP     :SLEEP BETWEEN INTERRUPTS
118 F04A 20 FD        BRA    DOZE   :TO MINIMIZE POWER DRAIN
119          :
120          :*****
121          : HELP FILE
122          LIST ON
123 F800            ORG    $F800
124 F800 6C 70 0D 0A HELPPIL:DB  'lp',SOD,SOA
125 F804 4D 6F 6B 69 DB    'Monitor Commands [enter via _ or ? or !]',SOD,SOA
F808 74 6F 72 20
F80C 43 6F 6D 6D
F810 61 6B 64 73
F814 20 28 65 6E
F818 74 65 72 20
F81C 76 69 61 20
F820 5F 20 6F 72
F824 20 3F 20 6F
F828 72 20 21 29
F82C 0D 0A
126 F82E 20 5F 20 28 DB    '_ (space) enter monitor',SOD,SOA
F832 73 70 61 63
F836 65 29 20 65
F83A 6E 74 65 72
F83E 20 6D 6F 6E
F842 69 74 6F 72
F846 2A 0D 0A
127 F849 20 3F 4D 61 DB    '?Maaaa_llllcr *',SOD,SOA
F84D 61 61 61 5F
F851 6C 6C 6C 6C
F855 63 72 20 2A
F859 0D 0A
128 F85B 20 21 4D 61 DB    '!Maaaa_dd...cr *',SOD,SOA
F85F 61 61 61 5F
F863 64 64 2E 2E
F867 2E 63 72 20
F86B 2A 0D 0A
129 F86E 20 20 77 69 DB    ' with all RCA UT4 conventions',SOD,SOA
F872 74 68 20 61
F876 6C 6C 20 52
F87A 43 41 20 55
F87E 54 34 20 63
F882 6F 6B 76 65
F886 6B 74 69 6F
F88A 6B 73 0D 0A
130 F88E 43 6F 6B 74 DB    'Control Commands',SOD,SOA
F892 72 6F 6C 20

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

F896	43 6F 6D 6D			
F89A	61 6B 64 73			
F89E	0D 0A			
131 F8A0	20 21 50 31	DB	' !P1hh ,!P2hh_ set pump power to hh *',SOD,SOA	
F8A4	68 68 5F 20			
F8A8	2C 21 50 32			
F8AC	68 68 5F 20			
F8B0	73 65 74 20			
F8B4	70 75 6D 70			
F8B8	20 70 6F 77			
F8BC	65 72 20 74			
F8C0	6F 20 68 68			
F8C4	20 2A 0D 0A			
132 F8C8	20 3F 50 31	DB	' ?P1 , ?P2 shows current pump setting *',SOD,SOA	
F8CC	20 2C 20 3F			
F8D0	50 32 20 73			
F8D4	68 6F 77 73			
F8D8	20 63 75 72			
F8DC	72 65 6B 74			
F8E0	20 70 75 6D			
F8E4	70 20 73 65			
F8E8	74 74 69 6E			
F8EC	67 20 2A 0D			
F8F0	0A			
133 F8F1	20 58 20 28	DB	' X (may be 'PCX only) Immeadiate Shutdown',SOD,SOA	
F8F5	6D 61 79 20			
F8F9	62 65 20 78			
F8FD	50 43 58 20			
F901	6F 6E 6C 79			
F905	29 20 49 6D			
F909	6D 65 61 64			
F90D	69 61 74 65			
F911	20 53 68 75			
F915	74 64 6F 77			
F919	6E 0D 0A			
134 F91C	0D 0A	DB	SOD,SOA	
135 F91E	20 2A 20 72	DB	* returns prompt '	
F922	65 74 75 72			
F926	6E 73 20 70			
F92A	72 6F 6D 70			
F92E	74 20			
136 F930	00 00	DB	S00,S00 :TERMINATOR	
137			*****	
138			: SCI INTERRUPT HANDLER (SAIL DRIVER)	
139 F932	7B 40 11	SCISTRRT:TIM	#\$40,TRCSR :TEST ORFE	
140 F935	27 03	BNE	CRCCHAR	
141		LIST OFF		
142 F937	96 12	LDAA	RECD :READ BAD CHAR TO CLEAR?	
143 F939	3B	SCIXIT: RTI	: & EXIT	
144		:		
145 F93A	7B 80 11	CKCHAR: TIM	#\$80,TRCSR :TEST DA	
146 F93D	26 03	BNE	READD :IF NOT, XMIT	
147 F93F	7B FC 10	JMP	CHECKX	
148		:		
149 F942	96 12	READD:	LDAA RECD :READ DATA TO A..	
150 F944	16	TAB	:AND COPY TO B	
151 F945	CB FD 66	LDX	#PARITY :POINT PARITY TABLE	

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

152 F948 3A           ABX          :POINT INTO PARITY TABLE
153 F949 E6 00         LDAB 0,X      :GET PARITY WORD
154 F94B 26 EC         BNE SCIXIT   :REJECT IF NOT EVEN PARITY
155 F94D 84 7F         ANDA #$7F    :ELSE REMOVE PARITY FOR SUBSEQUENT TESTS
156 F94F 16             TAB          :(ALSO COPY TO B)
157 F950 C8 23         EORB #'#     :IS IT '#'?
158 F952 27 03         BEQ GOTNUM   :
159 F954 7E 00 80       JMP RJUMP    :ELSE GO THRU VECTOR
160 :
161 : SAIL ADDRESS RECOGNIZE SECTION
162 F957 C6 01         GOTNUM: LDAB #01    : GOT # CODE
163 F959 D7 89         STAB SCRATCH1 :SET SAIL FLAG TO 01
164 F95B 71 FB 11       AIM  $SFB,TRCSR :OFF XMIT IF REQ'D?
165 F95E CC F9 66       LDD  #READAD  :POINT READ ADDRESS
166 F961 DD 81         STD  RVECT   :
167 F963 7E F9 39       JMP  SCIXIT  :AND EXIT
168 :
169 F966 D6 89         READAD: LDAB SCRATCH1 :GET SMODE COUNT
170 F968 C1 01         CMPB #$01    :IS THIS THE FIRST CHAR?
171 F96A 26 04         BNE TRYADD  :
172 F96C 81 30         CMPA #'0'    :IF FIRST, IS IT '0'?
173 F96E 27 2E         BEQ TSTBAUD :IF SO, MAY BE BAUD SWITCH
174 :
175 F970 C8 F0 00       TRYADD: LDX #ADDR  :CONTINUE ON BELOW...
176 F973 3A             ABX          :ELSE POINT X TO ADDR
177 F974 A1 00         CMPA 0,X      :ADD TO X
178 F976 27 13         BEQ NEXTAD  :COMPARE NEW CHAR TO A
179 :
180 F978 CC F9 7D       SETUNAD:LDD #UNADDR :IF MATCH, LOOK FOR NEXT CHAR
181 F97B DD 81         STD  RVECT  :
182 :
183 F97D 7F 00 89       UNADDR: CLR SCRATCH1 :CLEAR SAIL MODE TO 00
184 F980 71 FB 11       AIM  $SFB,TRCSR :STOP XMIT INTRPTS
185 F983 CC F0 19       LDD  #XPASS   :SET XMIT VECTOR TO PASS
186 F986 DD 84         STD  XVECT   :
187 F988 7E F9 39       JMP  SCIXIT  :
188 :
189      NEXTAD: INK      :POINT NEXT ADD CHAR
190 F98C 7C 00 89       INC  SCRATCH1 :(& INC COUNTER)
191 F98F 6D 00         TST  0,X      :TEST IT.
192 F991 27 03         BEQ GOTADDR : TERMINATOR?
193 F993 7E F9 39       JMP  SCIXIT  :ELSE SAME VECTOR
194 :
195 F996 CC FA 13       GOTADDR:LDD #CONCHAR :REC CONTROL CHAR NEXT..
196 F999 DD 81         STD  RVECT  :
197 F99B 7E F9 39       JMP  SCIXIT  :
198 :
199      : TEST FOR BAUD CHANGE COMMAND
200 F99E CC F9 A6       TSTBAUD:LDD #BAUD2  :
201 F9A1 DD 81         STD  RVECT  :
202 F9A3 7E F9 39       JMP  SCIXIT  :
203 :
204 F9A6 81 30         BAUD2: CMPA #'0'   :GOT SECOND 0?
205 F9A8 27 03         BEQ BAUD3   :
206 F9AA 7E F9 78       JMP  SETUNAD :
207 :
208 F9AD CC F9 BA       BAUD3: LDD  #BAUD4  :HERE IF GOT #00 (BAUD CHANGE)

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

209 F9B0 DD 81      STD    RVECT
210 F9B2 CE 00 89    LDX    #SCRTCH1   :POINT TO 5 CHAR BUFFER
211 F9B5 DF 87      STX    VECT2     :SAVE AT VECT2
212 F9B7 7E F9 39    JMP    SCIXIT
213 :
214 F9BA DE 87      BAUD4: LDIX   VECT2   :GET POINTER
215 F9BC 81 20      CMPA   #' '    :IS IT SPACE?
216 F9BE 26 02      BNE    BAUD5
217 F9C0 86 30      LDAA   #'0'    :..CHAO 0'S
218 F9C2 A7 00      BAUD5: STAA   0,X    :STORE CHAR
219 F9C4 08          INX    :ADVANCE POINTER
220 F9C5 8C 00 8E    CPX    #SCRTCH1+5 :PAST END OF 5 CHAR BUFFER?
221 F9C8 27 05      BEQ    BAUD6
222 F9CA DF 87      STX    VECT2   :IF NOT DONE, SAVE POINTER
223 F9CC 7E F9 39    JMP    SCIXIT :AND GET MORE
224 :
225 F9CF DE 8C      BAUD6: LDIX   SCRTCH1+3 :GET LAST TWO CHARS
226 F9D1 8C 30 30    CPX    #S3030   :ARE LAST TWO CHARS BOTH 0?
227 F9D4 26 31      BNE    WAITBRK :IF NOT VALID, SET UP TO WAIT FOR BREAK
228 :
229 F9D6 CC FA 0E    LDD    #BAUDTBL :SET UP TABLE POINTER
230 F9D9 DD 87      STD    VECT2   :AND STORE IN JUMP2 VECTOR
232 :
233 F9DB DE 87      BTRY:  LDIX   VECT2   :TRY EACH TABLE SEPARATELY, 00 AS 1ST CHAR SIGNALS END OF TABLE
234 F9DD A6 00      LDAA   0,X    :GET TABLE POINTER
235 F9DF 27 26      BEQ    WAITBRK :AND TABLE ELEMENT
236 F9E0 00 00      BNE    : IF=00, WAS NO MATCH, WAIT FOR BREAK
237 :
238 F9E1 CB 00 89    LDIX   #SCRTCH1 :COMPARE BUFFER WITH ONE TABLE ENTRY
239 F9E4 DF 84      STX    XVECT   :INIT BUFFER POINTER TO TOP
240 F9E8 A6 00      : & SAVE IN XMIT JUMP VECTOR
241 F9EB DE 84      COMPARE:LDIX XVECT :COMPARE EACH CHARACTER
242 F9E6 DE 84      LDAA   0,X    :GET BUFFER POINTER
243 F9E8 A6 00      LDAA   0,X    : TO GET BUFFER CHAR TO A
244 F9EA 08          INX    : INX BUF POINT WHILE WE'RE HERE
245 F9EB DF 84      STX    XVECT   : & SAVE..
246 F9ED DE 87      LDIX   VECT2   :NOW GET TABLE POINTER
247 F9EF A1 00      CMPA   0,X    : & USE TO COMPARE CHARS
248 F9F1 26 09      BNE    NOMATCH
249 F9F3 08          CMATCH:INX :IF MATCH, MOVE AHEAD TABLE POINTER
250 F9F4 A6 00      LDAA   0,X    :LOOK AT NEXT TABLE ELEMENT
251 F9F6 27 1C      BEQ    MATCH   : IF IT'S 00, FULL MATCH!
252 F9F8 DF 87      STX    VECT2   : ELSE SAVE TABLE POINTER
253 F9FA 20 EA      BRA    COMPARE : AND TRY NEXT CHAR
254 :
255 F9FC 08          NOMATCH:INX :INC TABLE POINTER
256 F9FD A6 00      LDAA   0,X    :AND LOOK FOR 00
257 F9FF 26 FB      BNE    NOMATCH :LOOP TILL IT'S FOUND
258 FA01 08          INX    :INC OVER NULL
259 FA02 08          INX    : & BAUD SET BYTE
260 FA03 DF 87      STX    VECT2   :AND REPLACE TO HOLDING LOCATION
261 FA05 20 D4      BRA    BTRY   :GO BACK TO CHECK NEXT TABLE
262 :
263 FA07 86 0A      WAITBRK:LDAA #SOA   :TURN OFF SCI INTERRUPTS
264 FA09 97 11      STAA   TRCSR  : (REQUIRES TOP INTERRUPT TO RESTART)
265 FA0B 7E F9 78      JNP    SETUNAD :AND SET VECTORS FOR NEW ADDRESS..

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

266          :
267          : MATCH TABLE FOR BAUD RATE SWITCH
268 FA08 30 30 33 00 BAUDTBL:DB    '003',$00,$01  : 300 baud is only rate allowed
269 FA12 01
270 FA13 00           DB      $00      :DONE
271 FA14 08           MATCH: INX      :PASS 00 TERMINATOR
272 FA15 A6 00           LDAA    0,X      :GET BAUD BYTE
273 FA17 16           TAB      :SAVE IN B
274          : This unit has no baud change hardware, these lines are kept here
275          : to allow it to be added later.
276          : ORAA  PORT1      :SET BITS ON BAUD CONTROL PORT
277          : STAA  PORT1
278          : ORAB  #$F8      :CLEAN UP MASK SO OTHERS DON'T CHANGE
279          : ANDB  PORT1      : WHEN CLEAR BITS..
280          : STAB  PORT1      : IN PORT1 (BAUD SET PORT)
281 FA18 7E F9 78           JMP     SETUNAD   :AND PREPARE FOR NEW ADDRESSING
282          :
283          : AFTER VALID ADDRESS, RECEIVE CONTROL CHAR..
284 FA1B 01           CONCHAR:NOP
285 FA1C 81 21           CMPA  #'!'      :IS IT '!'
286 FA1E 27 13           BEQ   BANG
287 FA20 81 3F           CMPA  #'?'      :OR IS IT '?'
288 FA22 27 22           BEQ   QUERY
289 FA24 81 20           CMPA  #' '       : SPACE TO ENTER MONITOR?
290 FA26 27 3D           BEQ   GOMON
291 FA28 81 48           CMPA  #'H'      :HELP?
292 FA2A 27 48           BEQ   SAYHELP
293 FA2C 81 58           CMPA  #'X'      : IMMEDIATE STOP?
294 FA2E 27 38           BEQ   XSTOP
295 FA30 7E F9 78           JMP     SETUNAD   :UNADDRESS IF NOT VALID..
296          :
297          :
298 FA33 CC FA 3B           BANG: LDD      #GOTBANG  :GOT ! PREFIX
299 FA36 DD 81           STD      RVECT
300 FA38 7E F9 39           JMP     SCIXIT
301          :
302 FA3B 81 4D           GOTBANG:CMPA  #'M'      :?M COMMAND?
303 FA3D 27 20           BEQ   BANGML
304 FA3F 81 50           CMPA  #'P'      :?P COMMAND?
305 FA41 27 1F           BEQ   BANGPL
306 FA43 7E F9 78           JMP     SETUNAD
307          :
308 FA46 CC FA 4E           QUERY: LDD      #GOTQUERY
309 FA49 DD 81           STD      RVECT
310 FA4B 7E F9 39           JMP     SCIXIT
311          :
312 FA4E 81 4D           GOTQUERY:CMPA  #'M'      :?M COMMAND?
313 FA50 27 07           BEQ   QUERYML
314 FA52 81 50           CMPA  #'P'      :?P COMMAND
315 FA54 27 06           BEQ   QUERYPL
316 FA56 7E F9 78           JMP     SETUNAD
317          :
318 FA59 7E FA 92           QUERYML:JMP   QUERYM   :LINK TO ?M
319 FA5C 7E FB 32           QUERYPL:JMP   QUERYP   :LINK TO ?P
320 FA5F 7E FA B4           BANGML: JNP    BANGH   :LINK TO !M
321 FA62 7E FB 67           BANGPL: JNP    BANGP   :LINK TO !P

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

322 FA65 7E FC BA      GOMON: JMP      PROMPT      :LINK INTO MONITOR
323
324 : IMMEDIATE STOP
325 FA68 71 FC 02      XSTOP: AIM      #$FC,PORT1   :DROP BOTH ENABLE BITS
326 FA6B 86 00          LDAA     $800       :AND SET PORTS TO 00
327 FA6D 97 06          STAA     PORT3
328 FA6F 97 07          STAA     PORT4
329 FA71 7E F9 78      JMP      SETUNAD
330 :
331 : HELP FILE DUMP
332 FA74 CC FA 83      SAYHELP:LDD  #OUTHELP
333 FA77 DD 84          STD      XVECT
334 FA79 CC F8 00      LDD      #HELPFIL    :SET POINTER
335 FA7C DD 89          STD      SCRATCH1
336 FA7E 86 65          LDAA     #'e'      :SEND FIRST LETTER OF REPLY
337 FA80 7E FC C1      JMP      SETOUT
338 :
339 FA83 DC 89          OUTHELP:LDX  SCRATCH1   :GET POINTER
340 FA85 A6 00          LDAA     0,X        :GET CHAR ->A
341 FA87 27 06          BEQ      HELPDUN    :NUL IS TERMINATOR
342 FA89 08              INX      :MEANWHILE, INC POINTER
343 FA8A DF 89          STX      SCRATCH1   :AND SAVE
344 FA8C 7E FC C1      JMP      SETOUT    :FINALLY SEND THE CHAR IN A..
345 :
346 FA8F 7E FC BA      HELPDUN:JMP  PROMPT
347
348 :
349 : ?M COMMAND - DATA INPUT SECTION
350 FA92 CC FA 98      QUERYM: LDD  #$SAVEADD   :NOW INPUT ADDRESS
351 FA95 7E FB BB      JMP      IN4
352 :
353 FA98 DC 89          SAVEADD:LDD  SCRATCH1   :GET ADDRESS,
354 FA9A DD 8B          STD      SCRATCH3  ADDRESS POINTER
355 FA9C CC FA A2      LDD      #STARTL
356 FA9F 7E FB BB      JMP      IN4        :THEN GET LENGTH
357 :
358 FAA2 DC 89          STARTL: LDD  SCRATCH1   :IF LENGTH NE 0000
359 FAA4 26 03          BNE      STARTL2    ; CARRY ON..
360 FAA6 7E FC BA      JMP      PROMPT    :ELSE QUIT
361 :
362 FAA9 CC FB B5      STARTL2:LDD  #ECHO    :PREPARE TO IGNORE ECHO CHARS
363 FAAC DD 81          STD      RVECT
364 FAAC 72 04 11      OIM      #$804,TRCSR :START XMIT INTERRUPTS
365 FAB1 7E FC 1F      JMP      OUTLINE   :& SEND A LINE..
366 :
367 : ..THE ?M DUMP IS STORED IN THE XMIT SERVICE SECTION BELOW
368 :
369 :
370 : !M SECTION
371 FAB4 CC FA BA      BANGM: LDD  #$KEEPADD  :INPUT STARTING ADDRESS
372 FAB7 7E FB BB      JMP      IN4
373 :
374 FABA CC FA C2      KEEPADD:LDD  #HHEX    :WAIT FOR HIGH HEX CHAR
375 FABD DD 81          STD      RVECT
376 FABF 7E F9 39      JMP      SCIXIT
377 :
378 FAC2 BD FD 16      HHEX: JSR   ASCHEX   :ATTEMPT CONVERT TO HEX

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

379	FAC5	25 27		BCS	TERMIN	:CHECK TERMINATOR IF NOT..
380	FAC7	48		ASLA		
381	FAC8	48		ASLA		:MOVE OVER NIBBLE
382	FAC9	48	FACA 48			ASLA
384	FACB	97 8D		STAA	SCRTCH5	
385	FACD	CC FA D5		LDD	#LOWHEX	
386	FAD0	DD 81		STD	RVECT	
387	FAD2	7E F9 39		JMP	SCIEXIT	
388		:				
389	FAD5	BD FD 16	LOWHEX:	JSR	ASCHEX	:CONVERT LOW
390	FAD8	24 03		BCC	STASH	
391	FADA	7E FC BA		JMP	PROMPT	:PROMPT IF BAD SECOND CHAR
392	FADD	DE 89	STASH:	LDX	SCRTCH1	:GET POINTER
393	FADE	9A 3D		ORAA	SCRTCH5	:COMBINE NIBBLES
394	FAE1	A7 00		STAA	0,X	:STORE IT..
395	FAE3	08		INX		:INC &
396	FAE4	DF 89		STX	SCRTCH1	:RESTORE POINTER
397	FAE6	CC FA C2		LDD	#HIHEX	
398	FAE9	DD 81		STD	RVECT	:&PREP FOR MORE
399	FAEB	7E F9 39		JMP	SCIEXIT	
400		:				
401	FAEB	84 7F	TERMIN:	ANDA	#\$7F	:MASK OFF FLAG BIT
402	FAF0	81 0D		CMPA	#\$0D	:IS IT CR?
403	FAF2	26 03		BNE	TERMIN2	
404	FAF4	7E FC BA		JMP	PROMPT	
405		:				
406	FAF7	81 20	TERMIN2:CMPA		#\$'	:IS IT SPACE?
407	FAF9	26 08		BNE	TERMIN3	
408	FAFB	CC FA C2		LDD	#HIHEX	
409	FAFE	DD 81		STD	RVECT	
410	FB00	7E F9 39		JMP	SCIEXIT	
411		:				
412	FB03	81 3B	TERMIN3:CMPA		#\$':'	:OR ',' ?
413	FB05	26 05		BNE	TERMIN4	
414	FB07	CC FA B4		LDD	#BANGM	
415	FB0A	20 07		BRA	PASSLF	
416		:				
417	FB0C	81 2C	TERMIN4:CMPA		#\$',''	:OR ',' ?
418	FB0E	26 1F		BNE	TERMIN5	
419	FB10	CC FB 27		LDD	#SETHIX	
420	FB13	DD 87	PASSLF:	STD	VECT2	
421	FB15	CC FB 1D		LDD	#PASSLF2	
422	FB18	DD 81		STD	RVECT	
423	FB1A	7E F9 39		JMP	SCIEXIT	
424		:				
425	FB1D	81 0A	PASSLF2:CMPA		#\$OA	:GOT LF YET?
426	FB1F	26 03		BNE	PXIT	
427	FB21	7E 00 86		JMP	JUMP2	:IF YES, EXIT THRU JMP2
428	FB24	7E F9 39	PXIT:	JMP	SCIEXIT	:ELSE WAIT FOR MORE CHARS..
429		:				
430	FB27	CC FA C2	SETHIX:LDD		#HIHEX	:IF ',' THEN PREP FOR MORE HEX
431	FB2A	DD 81		STD	RVECT	
432	FB2C	7E F9 39		JMP	SCIEXIT	
433		:				
434	FB2F	7E FC BA	TERMIN5:JMP	PROMPT		:TO PROMPT IF NOT VALID CHAR
435		:				

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

436          : QUERY PUMP COMMAND (?Pn, N=1,2)
437 FB32 CC FB 3A      QUERYP: LDD    #QP2
438 FB35 DD 81          STD     RVECT
439 FB37 7E F9 39       JMP     SCIXIT
440          :
441 FB3A 81 31      QP2:  CMPA   #'1'      :PUMP 1?
442 FB3C 26 04          BNE    QP3
443 FB3E C6 06          LDAB   #PORT3    :PORT 3 ADDRESS TO B
444 FB40 20 09          BRA    QP5      :AND GO FIND VALUE
445          :
446 FB42 81 32      QP3:  CMPA   #'2'      :PUMP 2?
447 FB44 27 03          BEQ    QP4
448 FB46 7E F9 78       JMP     SETUNAD
449          :
450 FB49 C6 07      QP4:  LDAB   #PORT4    :IF 2, POINT PORT 4
451 FB4B CE 00 00       QP5:  LDX    #0000    :CLEAR INDEX REGISTER
452 FB4E 3A          ABX
453 FB4F A6 00          LDAA   0,X      :FETCH VALUE FROM PORT
454 FB51 97 89          STAA   SCRTCH1  :AND SAVE
455 FB53 CC FB 5D       LDD    #QP6
456 FB56 DD 84          STD     XVECT    :PREP FOR NEXT
457 FB58 86 3D          LDAA   #'='      :SEND =
458 FB5A 7E FC C1       JMP     SETOUT
459          :
460 FB5D CC FB 67       QP6:  LDD    #QP7      :PREP FOR PROMPT
461 FB60 DD 87          STD     VECT2
462 FB62 96 89          LDAA   SCRTCH1  :GET PUMP CONTROL VALUE.
463 FB64 7E FC 9D       JMP     OUTBYTE
464          :
465 FB67 CC FC BA       QP7:  LDD    #PROMPT
466 FB6A DD 84          STD     XVECT
467 FB6C 7E F9 39       JMP     SCIXIT
468          :
469          -----
470          : SET PUMP SPEED COMMAND (!Pnhh n=1,2 hh=value)
471
472 FB6F CC FB 77       BANGP: LDD    #BP1      :IMMEDIATELY AFTER !P,
473 FB72 DD 81          STD     RVECT    :PREPARE FOR N
474 FB74 7E F9 39       JMP     SCIXIT
475          :
476 FB77 CB 00 06       BP1:  LDX    #PORT3    :SET ADDRESS OF PUMP1
477 FB7A 81 31          CMPA   #'1' PUMP 1 ?
478 FB7C 27 0A          BEQ    BP2
479 FB7E CE 00 07       LDX    #PORT4    :NEXT SET ADDRESS OF PUMP2
480 FB81 81 32          CMPA   #'2'      :PUMP 2 ?
481 FB83 27 03          BEQ    BP2
482 FB85 7E FC BA       JMP     PROMPT   :PROMPT IF NOT 1 OR 2
483          :
484 FB88 DF 90          BP2:  STX    PUMP    :SAVE PUMP ADDRESS
485 FB8A CC FB 90       LDD    #BP3
486 FB8D 7E FB BB       JMP     IN4      :AND GO READ NEW PUMP VALUE
487          :
488 FB90 DB 90          BP3:  LDX    PUMP    :RETRIEVE PUMP ADDRESS
489 FB92 C6 01          LDAB   #01      :SET PUMP1 FLAG
490 FB94 8C 00 06       CPX    #PORT3
491 FB97 27 0A          BEQ    BP4
492 FB99 C6 02          LDAB   #02      :ELSE SET PUMP2 FLAG

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

493 FB9B 8C 00 07      CPX    #PORT4
494 FB9E 27 03          BEQ    BP4
495 FBA0 7E F9 78      JMP    SETUNAD   :ERROR IF NOT VALID ADDRESS!
496 :
497 FBA3 96 8A          BP4:   LDAA   SCRTCH2  :RETRIEVE NEW VALUE
498 FBA5 A7 00          STAA   0,X    :AND STORE IN PUMP PORT
499 FBA7 26 08          BNE    BP6    :IS IT NOT 00?
500 FBA9 53              COMB   :
501 FBAA D4 02          ANDB   PORT1   :INVERT B TO CLEAR ENABLE BIT
502 FBAC D7 02          BP5:   STAB   PORT1   :AND WITH ENABLE PORT
503 FBAA 7E FC 8A      JMP    PROMPT  :AND MODIFY THE BIT.
504 :
505 FBB1 DA 02          BP6:   ORAB   PORT1   :ELSE ENABLE THE CORRECT BIT
506 FBB3 20 F7          BRA    BP5    :AND CARRY ON...
507 :
508 :
509 :-----: RECEIVE AN ECHO CHARACTER (& IGNORE!)
510 FBB5 01              ECHO:  NOP    :ROOM FOR JUMP...
511 FBB6 01              NOP    :
512 FBB7 01              NOP    :
513 FBB8 7E F9 39      JMP    SCIXIT
514 :
515 :
516 :-----: IN4 HEX DIGITS
517 :-----: INPUTS HEX DIGITS TILL TERMINATED BY A SPACE OR
518 :-----: BY A CR. (OR BY UNADDRESS). RESULT LEFT AT SCRTCH1,2
519 :-----: EXITS THRU JUMP2 WHEN DONE (TARGET IN D ON ENTRY)
520 :
521 FBBD DD 87          IN4:   STD    VECT2   :STORE EXIT VECTOR
522 FBBD 7F 00 89      CLR    SCRTCH1  :CLEAR INPUT BUFFER
523 FBCC 7F 00 8A      CLR    SCRTCH2  :
524 FBCC CC FB CB      LDD    #IN4HEX  :POINT CHAR RECEIVER
525 FBCC DD 81          STD    RVECT   :
526 FBCC 7E F9 39      JMP    SCIXIT
527 :
528 FBCC BD FD 16      IN4HEX: JSR    ASCHEX  :CONVERT TO HEX
529 FBCC 25 15          BCS    CKEND   :IF NOT HEX, CHECK FOR END
530 FBCC 36              PSHA   :
531 FBCC 96 89          LDAA   SCRTCH1  :HI TO A
532 FBCC D6 8A          LDAB   SCRTCH2  :
533 FBCC 05              ASLD   :
534 FBCC 05              ASLD   :
535 FBCC 05              ASLD   :
536 FBCC 05              ASLD   :
537 FBCC 97 89          STAA   SCRTCH1  :RETURN HIGH
538 FBCC D7 8A          STAB   SCRTCH2  :AND B
539 FBCC 32              PULA   :
540 FBCC 9A 8A          ORAA   SCRTCH2  :RETRIEVE NEW NIBBLE
541 FBCC 97 8A          STAA   SCRTCH2  :ADD NEW NIBBLE
542 FBCC 7E F9 39      JMP    SCIXIT  : & UPDATE
543 :
544 FBCC 84 7F          CKEND: ANDA   #$7F   :CLEAN OFF MS FLAG BIT
545 FBCC 81 20          CMPA   #'    :IS IT SPACE?
546 FBCC 27 07          BEQ    INEXIT  :
547 FBCC 81 0D          CMPA   #$0D   :IS IT CR?
548 FBCC 27 03          BEQ    INEXIT  :
549 FBCC 7E F9 39      JMP    SCIXIT  :ELSE, GET ANOTHER CHAR

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

550      :
551  FB#2  7E 00 86    :INEXIT: JMP      JUMP2      :IF DONE, CARRY ON THRU VECTOR..
552      :
553      :
554      :
555      :-----: INPUT ONE HEX BYTE AND CONTINUE THRU JUMP2
556  FB#5  48    INBYTE: ASLA      :MOVE OVER
557  FB#6  48    ASLA
558  FB#7  48    ASLA
559  FB#8  48    ASLA
560  FB#9  97 8D    STAA      SCRTCH5   :SAVE
561  FB#B  CC FC 03    LDD       #INBYTE2  :POINT TO NEXT SEGMENT
562  FB#E  DD 81    STD       RVECT
563  FC#0  7E F9 39    JMP       SCIXIT
564      :
565  FC#3  BD FD 16    INBYTE2:JSR  ASCHEX    :CONVERT LOW NIBBLE
566  FC#6  24 03    BCC       SAVEDAT
567  FC#8  7E F9 78    JMP       SETUNAD  :UNADDRESS IF ERROR
568      :
569  FC#B  9A 8D    SAVEDAT:ORAA  SCRTCH5   :COMBINE
570  FC#D  7E 00 86    JMP       JUMP2      :AND CARRY ON THRU VECTOR2
571      :
572  FC#10
573      :-----: NOW CHECK THE TRANSMIT SITUATION
574  FC#10 7B 20 11    CHECKXX: TIM   #S20,TRCSR  :TEST TDRE
575  FC#13 27 03    BEQ       XERROR
576  FC#15 7E 00 83    JMP       XJUMP     :GO THRU XMIT VECTOR
577      :
578      : THESE SEGMENTS ARE ENTERED THRU XJUMP AND XVECTOR..
579  FC#18 01    XERROR: NOP      :TRIG LOC FOR DIAGNOSTICS
580      :
581      : XJUMP TARGETS..
582  FC#19 71 FB 11    XPASS: AIM   #SPB,TRCSR  :TURN OFF XMIT INTERRUPTS
583  FC#C  7E F9 39    JMP       SCIXIT
584      :
585      :-----: OUTPUT A LINE OF DATA (FROM ?M DUMP)
586  FC#F  CC FC 29    OUTLINE:LDD  #OUTLF    :& SET UP TO XMIT
587  FC#22  DD 84    STD       XVECT
588  FC#4  86 9D    LDAA     #$0D      :SEND CR
589  FC#6  7E FC C1    JMP       SETOUT
590      :
591  FC#9  CC FC 33    OUTLP: LDD   #OUTADDR
592  FC#C  DD 84    STD       XVECT
593  FC#E  86 0A    LDAA     #$0A      :SEND LF
594  FC#0  7E FC C1    JMP       SETOUT
595      :
596  FC#3  CC FC 3D    OUTADDR:LDD  #LOWADDR  :PREP OUTBYTE XIT
597  FC#6  DD 87    STD       VECT2
598  FC#8  96 98    LDAA     SCRTCH3  :GET HIGH ADDRESS
599  FC#A  7E FC 9D    JMP       CUTBYTE
600      :
601  PC#D  CC FC 45    LOWADDR:LDD  #LOWADD2  :EXIT FROM 2ND OUTBYTE..
602  PC#0  DD 84    STD       XVECT
603  PC#2  7E F9 39    JMP       SCIXIT
604      :
605  PC#5  CC FC 4F    LOWADD2:LDD  #ADDRSP
606  PC#8  DD 87    STD       VECT2

```

SOPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

607	FC4A	96 8C	LDAA	SCRTCH4	:NOW LOW ADDRESS
608	FC4C	7E FC 9D	JMP	OUTBYTE	
609		:			
610	FC4F	CC FC 57	ADDRSP: LDD	#SENDSP	:EXIT FROM 2ND OUTBYTE...
611	FC52	DD 84	STD	XVECT	
612	FC54	78 F9 39	JMP	SCIIXIT	
613		:			
614	FC57	CC FC 61	SENDSP: LDD	#OUTDATA	
615	FC5A	DD 84	STD	XVECT	
616	FC5C	86 20	LDAA	\$20	:SEND SPACE
617	FC5E	7E FC C1	JMP	SETOUT	
618		:			
619	FC61	DE 8B	OUTDATA:LDX	SCRTCH3	:GET ADDR POINTER
620	FC63	A6 00	LDAA	0,X	:TO GET DATA BYTE
621	FC65	36	PSHA		:SAVE
622	FC66	CC FC 6F	LDD	#DECLEN	
623	FC69	DD 87	STD	VECT2	:PREP XIT VECTOR
624	FC6B	32	PULA		:RETRIEVE DATA BYTE
625	FC6C	7E FC 9D	JMP	OUTBYTE	:& SEND IT
626		:			
627	FC6F	CC FC 77	DECLEN: LDD	#DECLEN2	:EXIT FROM OUTBYTE2..
628	FC72	DD 84	STD	XVECT	
629	FC74	78 F9 39	JMP	SCIIXIT	
630		:			
631	FC77	DE 89	DECLEN2:LDX	SCRTCH1	:GET LENGTH
632	FC79	09	DEX		:DECREMENT
633	FC7A	DF 89	STX	SCRTCH1	:& RETURN
634	FC7C	26 03	BNE	SAYMORE	: MORE DATA?
635	FC7E	7E FC BA	JMP	PROMPT	:PROMPT IF DONE
636		:			
637	FC81	DE 8B	SAYMORE:LDX	SCRTCH3	:GET ADDR
638	FC83	08	INX		:INCREMENT
639	FC84	DF 8B	STX	SCRTCH3	:REPLACE
640	FC86	18	XGDX		:X REG TO ACCD
641	FC87	04	LSRD		:LSB TO C
642	FC88	25 D7	BCS	OUTDATA	:NEXT BYTE NOW IF ODD
643	FC8A	C4 07	ANDB	\$07	:CHECK FOR XXX0 (LINE END)
644	FC8C	26 C9	BNE	SENDSP	:IF ONLY EVEN, SEND SP
645		:			
646	FC8E	86 3B	LDAA	'.'	:IF NEW LINE, SEND CONTINUATION
647	FC90	BD FD 33	JSR	GENPAR	
648	FC93	97 13	STAA	XDATA	
649	FC95	CC FC 1F	LDD	#OUTLINE	:& PREP FOR NEW LINE..
650	FC98	DD 84	STD	XVECT	
651	FC9A	78 F9 39	JMP	SCIIXIT	
652		:			
653		:			
654		: OUTPUTS A BYTE IN A AS TWO HEX CHARS, EXITS VIA VECT2..			
655	FC9D	97 8D	OUTBYTE:STAA	SCRTCH5	:STASH FOR LATER
656	FC9F	44	LSRA		
657	PCA0	44	LSRA		:MOVE OVER
658	PCA1	44	LSRA		
659	PCA2	44	LSRA		
660	PCA3	BD FD 0B	JSR	HEXASC	:CONVERT
661	PCA6	36	PSHA		:AND SAVE..
662	PCA7	CC FC B0	LDD	#OUTBYT2	
663	PCAA	DD 84	STD	XVECT	

SDPUMPL.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

664 FCAC 32          PULA      :RECOVER CHARACTER
665 FCAD 7E FC C1    JMP       SETOUT
666 :
667 FCB0 96 8D        OUTBYT2:LDAA SCRTCH5
668 FCB2 84 0F        ANDA     #$0F
669 FCB4 BD FD 0B     JSR      HEXASC
670 FCB7 7E FD 03     JMP      OUTJMP   :CONVERT, SEND & JUMP THRU VECT2
671 :
672 :
673 :-----: SEND A PROMPT FROM THE MONITOR, THEN WAIT FOR CHARS
674 FCBA CC FC D1    PROMPT: LDD  #PROMPT1
675 FCBD DD 84        STD      XVECT
676 FCBF 86 0D        LDAA    #$0D    :SEND CR FIRST
677 :
678 : INITIATE A OUTPUT SEQUENCE
679 FCC1 BD FD 33    SETOUT: JSR GENPAR
680 FCC4 97 13        STAAB   XDATA   :SEND FIRST CHAR
681 FCC6 72 04 11    AIM     #$04,TRCSR :TURN ON INTERRUPTS IF REQ'D
682 FCC9 CC FB 95    LDD     #ECHO
683 FCCC DD 81        STD      RVECT   :& PREPARE TO ECHO
684 FCCE 7E F9 39    JMP      SCIXIT
685 :
686 FCD1 CC FC DA    PROMPT1:LDD #PROMPT2
687 FCD4 DD 84        STD      XVECT
688 FCD6 86 3A        LDAA    #$0A    :SEND LF
689 FCD8 20 E7        BRA     SETOUT
690 :
691 FCDA CC FC E3    PROMPT2:LDD #PROMPT3
692 FCDD DD 84        STD      XVECT
693 FCFD 86 3A        LDAA    #''
694 FCE1 20 DE        BRA     SETOUT
695 :
696 FCE3 86 03        PROMPT3:LDAA #$03    :FINALLY ETX
697 FCE5 BD FD 33    JSR     GENPAR
698 FCE8 97 13        STAAB   XDATA   :DRAGON HERE?
699 FCEA 71 FB 11    AIM     #$FB,TRCSR :NOW TURN OFF XMIT INTERRUPTS
700 FCED CC FC F5    LDD     #WAITPR1
701 FCF0 DD 81        STD      RVECT   :WAIT FOR ETX ECHO
702 FCF2 7E F9 39    JMP      SCIXIT
703 :
704 : WAIT FOR THE ETX TO ECHO BACK..
705 FCF5 81 03        WAITPR1:CMPA #$03    :IS IT THE ETX YET?
706 FCF7 26 05        BNE     WXIT    :IF NOT, WAIT FOR NEXT CHAR
707 FCF9 CC FA 1B    LDD     #CONCHAR
708 FCFC DD 81        STD      RVECT   :IF SO, CONTROL CHAR WILL BE NEXT
709 FCFE 7E F9 39    WXIT:  JMP      SCIXIT
710 :
711 :
712 : SENDS ETX & CARRIES ON THRU VECT2
713 FD01 86 03        ETX:   LDAA    #$03    :SEND ETX
714 FD03 BD FD 33    OUTJMP: JSR     GENPAR :MAY ENTER HERE...
715 FD06 97 13        STAAB   XDATA   :DRAGON AGAIN?
716 FD08 7E 00 86    JMP     JUMP2   :NOW THRU JUMP2
717 :
718 :
719 :-----: SUBROUTINES.....
720

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

721      ;-----
722      : Converts low nibble in A to ASCII char in A
723  FD0B  84 0F    HEXASC: ANDA  #SOF      :CLEAN IT UP
724      FD0D  8B F6    ADDA  #SF6
725      FD0F  24 02    BCC   HNUMBER
726      FD11  8B 07    ADDA  #S07      :CONVERT
727      FD13  8B 3A    HNUMBER:ADDA  #S3A      : TO ASCII
728      FD15  39      RTS
729      ;
730      ;-----
731      : Converts ASCII char in A to nibble in A if it is HEX & sets C bit.
732      : Otherwise, returns original char with C bit set.
733  FD16  36      ASCHEX: PSRA      :SAVE CHAR
734  FD17  80 30    SUBA  #S30
735  FD19  25 15    BCS   NOTHEX
736  FD1B  80 0A    SUBA  #SOA
737  FD1D  2C 04    BGE   TSTALPH
738  FD1F  8B 0A    ADDA  #SOA      :REPAIR NUMB
739  FD21  20 0A    BRA   AXIT
740  FD23  80 07    TSTALPH:SUBA  #S07      :41->00 ?
741  FD25  2D 09    BLT   NOTHEX
742  FD27  80 06    SUBA  #S06
743  FD29  2C 05    BGE   NOTHEX
744  FD2B  8B 10    ADDA  #S10      :REPAIR ALPH
745  FD2D  31      AXIT: INS      :POP OFF SAVED CHAR
746  FD2E  CC       CLC      :AND CLEAR CARRY BIT
747  FD2F  39      RTS
748      ;
749  FD30  32      NOTHEX: PULA      :GET CHAR
750  FD31  0D       SEC      :SET CARRY
751  FD32  39      RTS
752      ;-----
753      : GENERATE PARITY- Char is passed in and out thru A
754  FD33  37      GENPAR: PSHB      :SAVE SOME STUFF..
755  FD34  3C       PSHX
756  FD35  16       TAB      :COPY CHAR TO B
757  FD36  CE FD 66    LDX   #PARITY :POINT TO PARITY TABLE TOP
758  FD39  3A       ABX      :ADD OFFSET TO POINT X TO CHAR
759  FD3A  AA 00    ORAA   0,X      :ADD PARITY BIT
760  FD3C  38       PULX      :..RESTORE
761  FD3D  33       PULB
762  FD3E  39       RTS
763      ;
764      ;*****
765      : TIMER INTERRUPT PROCESSING SECTIONS
766      ;
767      : TIMER OVERFLOW INTERRUPT, WATCHES FOR SAIL BREAK EXIT
768      ;
769  FD3F  96 08    TOP: LDAA  TCSR      :READ COUNTER STATUS REG
770  FD41  96 09    LDAA  COUNTHI : AND COUNTER TO CLEAR INTERRUPT
771  FD43  7B 80 02    TIM   #S80,PORT1 :TEST BREAK SENSE BIT
772  FD46  27 11    EQ    SETBRK ;IF LOW, SET BREAK FLAG
773      : IF NOT LOW, JUST RISEN?
774  FD48  96 8E    LDAA  BMODE
775  FD4A  2A 13    BPL   TOEXIT :IF WAS NO BREAK, CARRY ON..
776      : IF JUST CAME OUT OF BREAK...
777  FD4C  71 7F 8E    AIM   #S7F,BMODE :CLEAR BREAK FLAG

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

778 FD4F 72 10 11      OIM    #$10,TRCSR   :ENABLE SCI INTERRUPTS
779 FD52 CC F9 7D      LDD    #UNADDR
780 FD55 DD 81          STD    RVECT     :AND PRESET JUMP VECTOR..
781 FD57 20 06          BRA    TOFKIT
782 :
783 FD59 72 80 9E      SETBRK: OIM    #$80,BMODE  :SET BREAK FLAG
784 FD5C 71 EB 11      AIM    #SEB,TRCSR  :TURN OFF BOTH SCI INTERRUPTS
785 FD5F 3B             TOFKIT: RTI
786 :
787 :
788 :-----:           : OUTPUT COMPARE INTERRUPT
789 :
790 FD60 7B 40 08      OCI:   TIM    #40,TCSR
791 FD63 27 00          SEQ    EXIT    :EXIT IF NOT OCFlag
792 :
793 FD65 3B             DUMMY FOR INSTRUCTIONAL PURPOSES ONLY
794 OCI:   RTI    :AND EXIT..
795 ;*****:             : PARITY TABLE
796 FD66 00 80 80 00    PARITY: DB 00,80,80,00,80,00,00,80  :A
    FD6A 80 00 00 80
797 FD6E 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FD72 00 80 80 00
798 FD76 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FD7A 00 80 80 00
799 FD7E 00 80 80 00    DB 00,80,80,00,80,00,00,80  :A
    FD82 80 00 00 80
800 :
801 FD86 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FD8A 00 80 80 00
802 FD8E 00 80 80 00    DB 00,80,80,00,80,00,80,00  :A
    FD92 80 00 00 80
803 FD96 00 80 80 00    DB 00,80,80,00,80,00,00,80  :A
    FD9A 80 00 00 80
804 FD9E 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FDA2 00 80 80 00
805 :
806 FDA6 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FDAA 00 80 80 00
807 FDAA 00 80 80 00    DB 00,80,80,00,80,00,80,00  :A
    FDB2 80 00 00 80
808 FD86 00 80 80 00    DB 00,80,80,00,80,00,80,00  :A
    FDBA 80 00 00 80
809 FD8E 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FDC2 00 80 80 00
810 :
811 FDCE 00 80 80 00    DB 00,80,80,00,80,00,00,80  :A
    FDCA 80 00 00 80
812 FDCE 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FDD2 00 80 80 00
813 FDD6 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    FDDA 00 80 80 00
814 FDDE 00 80 80 00    DB 00,80,80,00,80,00,00,80  :A
    FDE2 80 00 00 80
815 :
816 PDE6 80 00 00 80    DB 80,00,00,80,00,80,80,00  :B
    PDEA 00 80 80 00
817 PDEE 00 80 80 00    DB 00,80,80,00,80,00,00,80  :A

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

FDF2 80 00 00 80
818 FDF6 00 80 80 00 DB 00,80,80,00,80,00,00,80 :A
FDFA 80 00 00 80
819 FDFF 80 00 00 80 DB 80,00,00,80,00,80,80,00 :B
FE02 00 80 80 00
820 : XXAO
821 FE06 00 80 80 00 DB 00,80,80,00,80,00,00,80 :A
FE0A 80 00 00 80
822 FE0E 80 00 00 80 DB 80,00,00,80,00,80,80,00 :B
FE12 00 80 80 00
823 FE16 80 00 00 80 DB 80,00,00,80,00,80,80,00 :B
FE1A 00 80 80 00
824 FE1E 00 80 80 00 DB 00,80,80,00,80,00,00,80 :A
FE22 80 00 00 80
825 : XXCO
826 FE26 00 80 80 00 DB 00,80,80,00,80,00,00,80 :A
FE2A 80 00 00 80
827 FE2E 80 00 00 80 DB 80,00,00,80,00,80,80,00 :B
FE32 00 80 80 00
828 FE36 80 00 00 80 DB 80,00,00,80,00,80,80,00 :B
FE3A 00 80 80 00
829 FE3E 00 80 80 00 DB 00,80,80,00,80,00,00,80 :A
FE42 80 00 00 80
830 : XXEO
831 FE46 80 00 00 80 DB 80,00,00,80,00,80,80,00 :A
FE4A 00 80 80 00
832 FE4E 00 80 80 00 DB 00,80,80,00,80,00,00,80 :B
FE52 80 00 00 80
833 FE56 00 80 80 00 DB 00,80,80,00,80,00,00,80 :B
FE5A 80 00 00 80
834 FE5E 80 00 00 80 DB 80,00,00,80,00,80,80,00 :A
FE62 00 80 80 00
835 :
836 ****
837 : DEFINE INTERRUPT AND RESET VECTORS
838 F0 08 TRAP: EQU START
839 : TOF: EQU START
840 : OCP: EQU START
841 F0 08 ICF: EQU START
842 F0 08 IRQ1: EQU START
843 F0 08 SWI: EQU START
844 F0 08 NMI: EQU START
845 F0 08 RESET: EQU START
846 :
847 FFEE ORG SPFFEE : SET HARDWARE VECTORS
848 FFEE F0 08 DW TRAP
849 FFFF0 F9 32 DW SCISTRT
850 FFFF2 FD 3F DW TOP
851 FFFF4 FD 60 DW OCI :OUTPUT COMPARE INTERRUPT
852 FFFF6 F0 08 DW ICF
853 FFFF8 F0 08 DW IRQ1
854 FFFF9 F0 08 DW SWI
855 FFFFC F0 08 DW NMI
856 FFFFZ F0 08 DW RESET
857 :
858 0000 END

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

***** CROSS REFERENCE TABLE *****

	FC10	:				
ADDR	F000	:	175			
ADDRSP	FC4F	:	605			
ASCHEX	FD16	:	378	389	528	565
AXIT	FD2D	:	739			
BANG	FA33	:	286			
BANGM	FAB4	:	320	414		
BANGML	FA5F	:	303			
BANGP	FB6F	:	321			
BANGPL	FA62	:	305			
BAUD2	F9A6	:	200			
BAUD3	F9AD	:	205			
BAUD4	F9BA	:	208			
BAUD5	F9C2	:	216			
BAUD6	F9CF	:	221			
BAUDTBL	FA0E	:	230			
BMODE	= 008E	:	114	774	777	783
BP1	FB77	:	472			
BP2	FB88	:	478	481		
BP3	FB90	:	485			
BP4	FB83	:	491	494		
BP5	FBAC	:	506			
BP6	FBB1	:	499			
BTRY	F9DB	:	261			
CAPTURHI	= 000D	:				
CAPTURLO	= 000E	:				
CHECKX	FC10	:	147			
CKCHAR	F93A	:	140			
CKEND	FBE5	:	529			
CMATCH	F9F3	:				
COMPARE	F9E6	:	253			
COMPARHI	= 000B	:				
COMPARLO	= 000C	:				
COMCHAR	FA1B	:	195	707		
COUNTHI	= 0009	:	770			
COUNTLO	= 000A	:				
DDR1	= 0000	:	85			
DDR2	= 0001	:	88			
DDR3	= 0004	:	90			
DDR4	= 0005	:	93			
DECLEN	FC6F	:	622			
DECLEN2	FC77	:	627			
DOZE	F049	:	118			
ECHO	FBB5	:	362	682		
GENPAR	FD33	:	647	679	697	714
GOMON	FA65	:	290			
GOTADDR	F996	:	192			
GOTBANG	FA3B	:	298			
GOTNUM	F957	:	158			
GOTQURY	FA4E	:	308			
HELPDUN	FA8F	:	341			
HELPFIL	F800	:	334			
HEXASC	FD0B	:	660	669		
HIBEX	FAC2	:	374	397	408	430

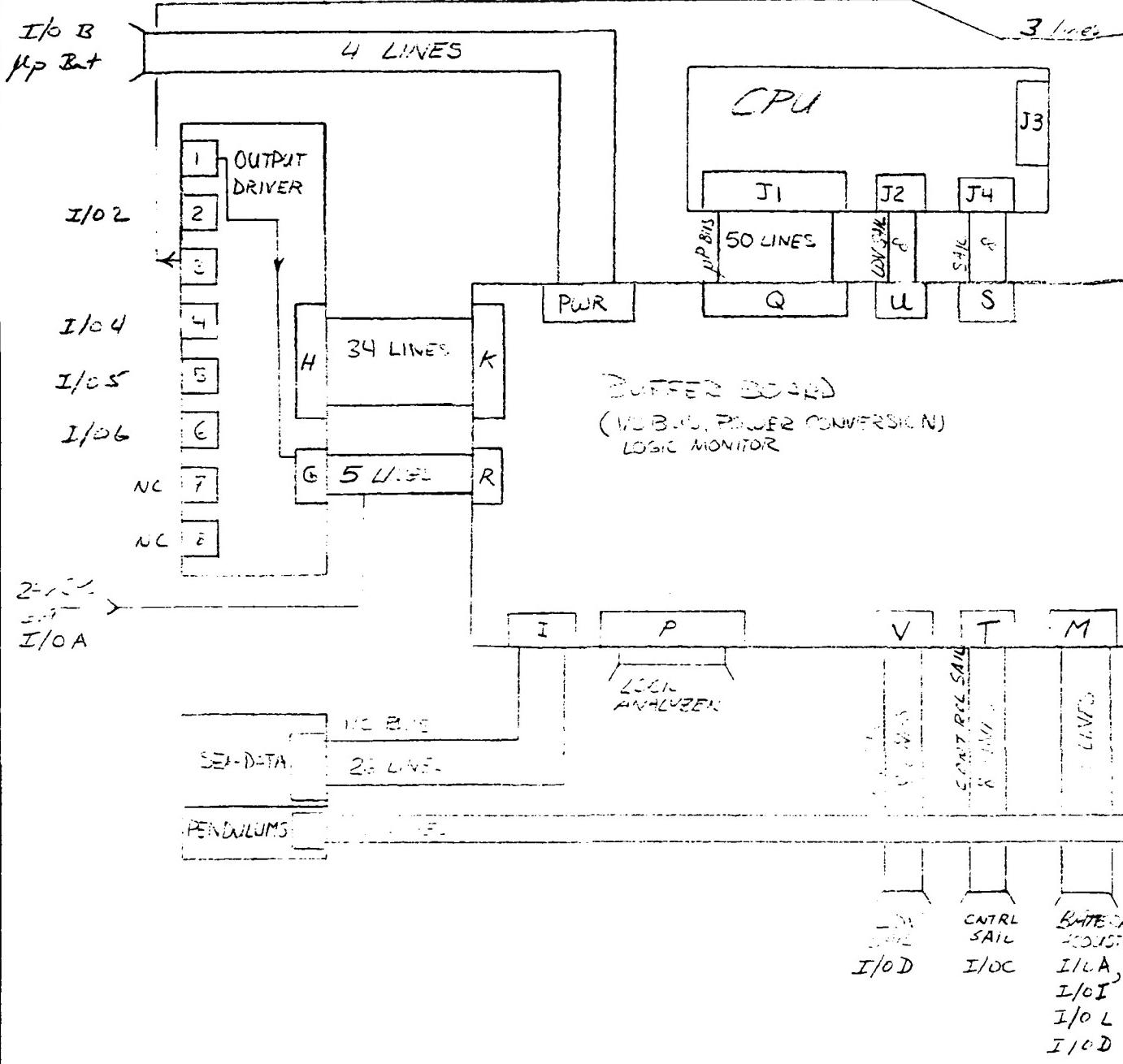
Appendix I
SEA DUCT - ELECTRONIC DRAWINGS

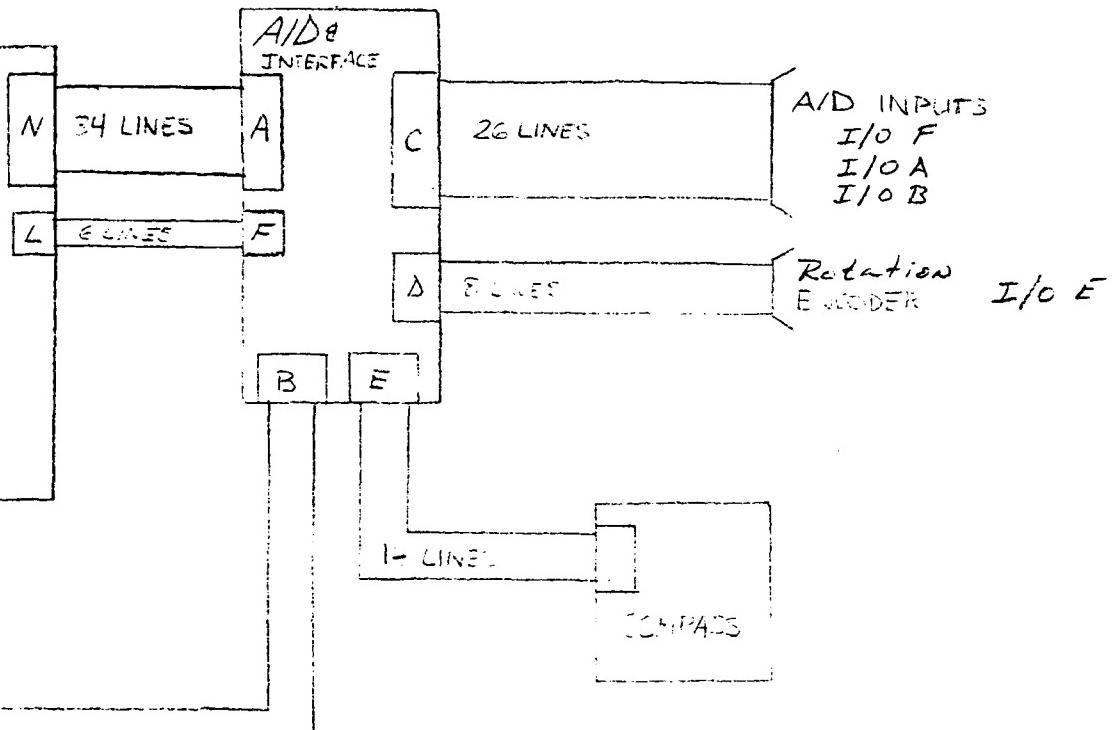
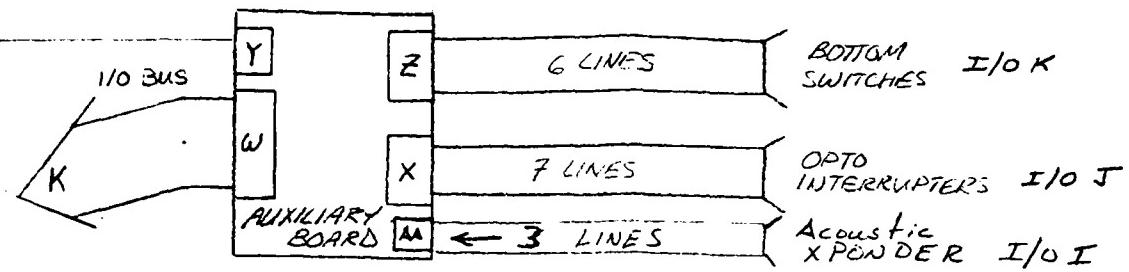
Dwg. #	Size	Title	Rev. Date.
SD-B001	B	Computer System Connection List	20 Nov. 84
SD-B002	B	Computer System Connections	20 Nov. 84
SD-B003	B	U/W Connectors (CPU System)	24 Nov. 86
SD-B004	B	I/O Decode	24 Nov. 86
SD-B005	B	Output Driver Decoding	24 Nov. 86
SD-B006	B	Pulse Driver Decoding, A/D, Mux. Decoding	23 Apr. 86
SD-B007	B	Software Timing	24 Nov. 86
SD-B008	B	Computer Ribbon Conn. Pin / Funct. Cross Ref.	04 Nov. 83
SD-B009	B	uP, System Battery	24 Mar. 87
SD-B010	B	SAIL, Camera, Transmissometer - External Conn.	02 Dec. 86
SD-B011	B	Bottom Sw., Opto. Int., Xponder - Ext. Conn.	23 Apr. 86
SD-B012	B	Buffer Board - Main Section	23 Apr. 86
SD-B013	B	Buffer Board - SAIL and Reset	12 Jun. 86
SD-B014	B	Buffer Board - Circulation Pump Control	24 Nov. 86
SD-B015	B	Buffer Board - Parts Layout	24 Nov. 86
SD-B016	B	Output Driver Board	24 Nov. 86
SD-B017	B	Output Driver Board - Parts Layout	24 Nov. 86
SD-B018	B	Interface Board - A/D, Voltage Convertor	24 Nov. 86
SD-B019	B	Interface Board - Compass Interface	15 Oct. 84
SD-B020	B	Interface Board - Rotation Encoder Interface	24 Nov. 86
SD-B021	B	Interface Board - Parts Layout	28 Sep. 83
SD-B022	B	Rotation Encoder Interface (Encoder Housing)	20 Nov. 84
SD-B023	B	LITTON Rotation Encoder	20 Nov. 84
SD-B024	B	Rotation Encoder Interface - Parts Layout	20 Nov. 84
SD-B025	B	Auxillary Board	24 Nov. 86
SD-B026	B	Auxillary Board - Parts Layout	05 Dec. 85
SD-B027	B	Manual Control Box (Connections)	24 Nov. 86
SD-B028	B	HP 1630D Analyzer Interface Box	02 Feb. 84
SD-B029	B	HP 1630D Analyzer Interface Box - Layout	18 Oct. 83
SD-B030	B	HP 1630D/HP 1610 Analyzer Interface Box	12 Jul. 84
SD-B031	B	Main Wiring Harness	28 Mar. 87
SD-B032	B	CPU Endcap - Electrical Connections	13 Dec. 85
SD-B033	B	Pump Controller - Control Circuit	26 Nov. 86
SD-B034	B	Pump Controller - Power Circuit	26 Nov. 86
SD-B035	B	Pump Controller - Board Layout	26 Nov. 86
SD-B036	B	Pump Controller - Block Diagram	26 Nov. 86
SD-B037	B	CMOS - RS232 Interface	24 Nov. 86
SD-B038	B	OIS Acoustic Command Xcvr. - Modifications	30 Dec. 86
SD-B039	B	OIS Acoustic Command Rcvr. - Modifications	30 Dec. 86
SD-B040	B	Photosea Camera Cable	28 Mar. 87
SD-C001	C	CPU BOARD (2 Sheets)	19 Dec. 85
SD-C002	C	Main Junction Box Wiring	18 Dec. 85
SD-D001	D	Electrical Master	31 Jul. 85

COLUMN	DEFINED	NUMBER	DEFINITION	NUMBER	DEFINITION	NUMBER	DEFINITION	NUMBER	DEFINITION
A	INTERFAC	/		34	ANAL INPUT	N	BUFFERED I/O BUS		
B	"	/		6	BB	Pendulums			
C	"	6	ANAL INPUTS	"					
D	"	6		"					
E	"	14	ANAL INPUTS	L	I/O E	Position Encoder (Rotation)			
F	"	6	ANAL INPUTS	CC	I/O A	Compass			
G	OUTPUT DEV.	34	ANAL INPUTS	"	I/O A	SYS. PWR			
H	"				I/O 2	Buf. Rot Pos Pwr, Trans Pwr			
J	"	8	ANAL INPUTS	Y	I/O 4	Relay Cam 2 Sel. Sample			
K	"	8	ANAL INPUTS	"	I/O 5	Relay Cam 4 Insert, Rotate, Suct, Clean			
L	"	8	ANAL INPUTS	"	I/O 6	Relay Cam 5 XYZ Position			
M	"	5	ANAL INPUTS	"		Relay Cam 6 Pumps & H2O Samples			
N	"	8	ANAL INPUTS	"					
O	"	8	ANAL INPUTS	"					
P	BUFFER	26	ANAL INPUTS	Q	SERIAL	Not Currently in Use			
Q	CPU	50	ANAL INPUTS	U	CAM BUS				
R	"	26	ANAL INPUTS	X7E:2:VAL	CHARTS (LDV SAIL)				
S	"	26	ANAL INPUTS	"	BOTTLE SWITCHES				
T	BUFFER	26	ANAL INPUTS	S	SAIL/RESET				
U	CPU	34	ANAL INPUTS	H,W	BUFFERED NO BUS				
V	BUFFER	34	ANAL INPUTS	F	POWER				
W	"	6	ANAL INPUTS	I/O(A,I,D,L)	SIM. PWR AND ACOUSTIC LINK, CAMERA, LDV RST				
X	"	8	ANAL INPUTS	A	BUFFERED I/O BUS				
Y	"	34	ANAL INPUTS						
Z	AUX	50	ANAL INPUTS						
AUX	"	50	ANAL INPUTS						
BB	"	8	ANAL INPUTS						
CC	"	8	ANAL INPUTS						
D	"	3	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10	ANAL INPUTS						
S	"	10	ANAL INPUTS						
T	"	10	ANAL INPUTS						
U	"	10	ANAL INPUTS						
V	"	10	ANAL INPUTS						
W	"	10	ANAL INPUTS						
X	"	10	ANAL INPUTS						
Y	"	10	ANAL INPUTS						
Z	"	10	ANAL INPUTS						
AUX	"	10	ANAL INPUTS						
BB	"	10	ANAL INPUTS						
CC	"	10	ANAL INPUTS						
D	"	10	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10	ANAL INPUTS						
S	"	10	ANAL INPUTS						
T	"	10	ANAL INPUTS						
U	"	10	ANAL INPUTS						
V	"	10	ANAL INPUTS						
W	"	10	ANAL INPUTS						
X	"	10	ANAL INPUTS						
Y	"	10	ANAL INPUTS						
Z	"	10	ANAL INPUTS						
AUX	"	10	ANAL INPUTS						
BB	"	10	ANAL INPUTS						
CC	"	10	ANAL INPUTS						
D	"	10	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10	ANAL INPUTS						
S	"	10	ANAL INPUTS						
T	"	10	ANAL INPUTS						
U	"	10	ANAL INPUTS						
V	"	10	ANAL INPUTS						
W	"	10	ANAL INPUTS						
X	"	10	ANAL INPUTS						
Y	"	10	ANAL INPUTS						
Z	"	10	ANAL INPUTS						
AUX	"	10	ANAL INPUTS						
BB	"	10	ANAL INPUTS						
CC	"	10	ANAL INPUTS						
D	"	10	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10	ANAL INPUTS						
S	"	10	ANAL INPUTS						
T	"	10	ANAL INPUTS						
U	"	10	ANAL INPUTS						
V	"	10	ANAL INPUTS						
W	"	10	ANAL INPUTS						
X	"	10	ANAL INPUTS						
Y	"	10	ANAL INPUTS						
Z	"	10	ANAL INPUTS						
AUX	"	10	ANAL INPUTS						
BB	"	10	ANAL INPUTS						
CC	"	10	ANAL INPUTS						
D	"	10	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10	ANAL INPUTS						
S	"	10	ANAL INPUTS						
T	"	10	ANAL INPUTS						
U	"	10	ANAL INPUTS						
V	"	10	ANAL INPUTS						
W	"	10	ANAL INPUTS						
X	"	10	ANAL INPUTS						
Y	"	10	ANAL INPUTS						
Z	"	10	ANAL INPUTS						
AUX	"	10	ANAL INPUTS						
BB	"	10	ANAL INPUTS						
CC	"	10	ANAL INPUTS						
D	"	10	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10	ANAL INPUTS						
S	"	10	ANAL INPUTS						
T	"	10	ANAL INPUTS						
U	"	10	ANAL INPUTS						
V	"	10	ANAL INPUTS						
W	"	10	ANAL INPUTS						
X	"	10	ANAL INPUTS						
Y	"	10	ANAL INPUTS						
Z	"	10	ANAL INPUTS						
AUX	"	10	ANAL INPUTS						
BB	"	10	ANAL INPUTS						
CC	"	10	ANAL INPUTS						
D	"	10	ANAL INPUTS						
E	"	10	ANAL INPUTS						
F	"	10	ANAL INPUTS						
G	"	10	ANAL INPUTS						
H	"	10	ANAL INPUTS						
I	"	10	ANAL INPUTS						
J	"	10	ANAL INPUTS						
K	"	10	ANAL INPUTS						
L	"	10	ANAL INPUTS						
M	"	10	ANAL INPUTS						
N	"	10	ANAL INPUTS						
O	"	10	ANAL INPUTS						
P	"	10	ANAL INPUTS						
Q	"	10	ANAL INPUTS						
R	"	10</td							

Y	"	3	
Z	"	10	
AUX	AUX	4	
BB	Pendulum	6	
CC	Compass	9	
TGA	To End Cap	14	
I/O B		9	
I/O C		4	
I/O D		4	
I/O E		9	
I/O F		11	
I/O G		9	
I/O H		9	
I/O I		6	
I/O J		7	
I/O K		9	
I/O L		2	
	To End Cap	8	
U/W A		11	
U/W B		4	
U/W C		8	
U/W D		1	
U/W E		1	
U/W F		1	
U/W Z		8	
U/W Y		1	
U/W X		1	
U/W L		1	
	To End Cap	888874	
XSG-3-BCL		888874	
XSG-4-BCL		888874	
"		888874	
XSK-8-BCL		888874	
XSG-4-BCL		888874	
"		888874	
XSR-S-FCL		888874	
"		888874	
XSK-3-FLC		888874	
"		888874	
XSG-4-BCL		888874	
"		888874	
		888874	

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82.69 BY ARD
SHEET 1 OF 1 DATE 7/10/83





LDV RST
 CAME 1A
 MTE PRELAC
 TOLIST, XPAUDR
 I/O A
 I/O I
 I/O L
 I/O D

REV. 20 Nov 84 WET

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 Woods Hole, Mass. 02543
 PROJ. 10102.69 BY ARD
 SHEET 2 OF 2 DATE 4 Nov 83

TITLE

Computer System Connectors
 SD-B-002 SEA DUCT
 SD-B-002

CPU Pressure Housing Connectors

Function	Conn.	Mates With	Wire	Other End	Connector
I/O A Main Battery (Relay Pod #1)	XSK-8-BCL 3 pins	RMK-8-FS w/K-FLS-P	30' 18/8 SO	DANCO	
I/O E Position Encoder	XSK-8-BCL	RMK-8-FS w/K-FLS-P	18/8 SD	RMK-8-FS w/K-FLS-P	XSK-8-BCL
Sail I/O to Control 1	XSG-4-BCL	RMG-4-FS	TWO SHIELDED PAIR IN	BARE FOR DUMMY	
I/O D to LDV	XSG-4-BCL	RMG-4-FS	oil tube	RMG-4-FS	XSG-4-BCL
Acoustic Link	6 PIN	RMK-8-FS	30'	Mecca Female (6)	Mecca (6)
I/O-I (XPONDER)	XSK-8-BCL 3 pins	w/K-FLS-P	18/8 SO to 6 INDIV.		
I/O-F Transmissometer	4 PIN	RMG-4-FS w/G-FLS-P	2 SHIELDED PAIR IN oil tube	VMG-4-FS w/G-FLS-P	VSG-4-BCL
XYZ Opto Encoder	XSK-8-BCL 3 pins	RMK-8-FS w/F-FLS-P	18/8 SO to 30'	DANCO	
Bottom + Sense	XSK-8-BCL 3 pins	RMK-8-FS w/Y-FLS-P	18/8 SO to 30'	DANCO	
I/O-K Switches	XSK-8-BCL 3 pins	RMK-8-FS w/Y-FLS-P	18/8 SO to 30'	DANCO	
I/O-L Camera	XSG-4-BCL 4 pins	RMG-4-FS w/G-FLS-P	18/4 SO	51F2F (Electro)	51F2H (Electro) See Note 3
I/O-2 Relay Pod # 2	XSK-8-BCL 3 pins	RMK-8-FS K-FLS-P	18/8 SO	DANCO	—
I/O-4 Relay Pod # 4	XSK-8-BCL 3 pins	RMK-8-FS K-FLS-P	18/8 SO	DANCO	—
I/O-5 Relay Pod # 5	XSK-8-BCL 3 pins	RMK-8-FS K-FLS-P	18/8 SO	DANCO	—
I/O-6 Relay Pod # 6	XSK-8-BCL 3 pins	RMK-8-FS K-FLS-P	18/8 SO	DANCO	—
I/O-3 HP Battery	XSG-4-BCL 4 pins	RMG-4-FS G-FLS-P	30' 18/4 SO to 30'	Mecca Female (4) or (2)	Mecca Male (4) or (2)
Pump Controller (Recirculate Pumps) SEE SAIL LDV	XSK-6-BCL also XSG-4-BCL SEE SAIL LDV	RMK-6-FS RMG-4-FS G-FLS-P K-FLS-P	10/2 SO	DANCO on Pumps + Box B	See Note 2
Emergency Battery to Emergency Acoustic Link	NEC-A Male (2)		?	Mecca Female (6)	* Not connected to

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

G-FLSP
 (2 G-FLS-P)
 to pump control

Note:

1. 9ea XSK-8-BCL } ON CPLU
 5ea XSG-4-BCL } Pressure Case
2. Current Configuration uses separate SAIL
 Controller in separate U/W Housing
 See Dwg. SD-B010, 8036
3. Ref. PhotoSea Systems - Dwg 155667 (7/83)
 "Carrie Diacon" - 15,000 FT. - Woods Hole
 "Sea System", or SD-B037

1c3

Note 2

connected to CPLU housing

REV. 24 Nov 86

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE <i>U/W Connectors (μP System)</i>		
CONTRACT NO. 10182.69	CODE NO.	SEA DUCT		
BY W.E.T.	DATE 11 July 84	SIZE B	DWG. NO. SD-B-003	OF 1
			REV. 31 Jul 85	

Input Output

Group Ø

- 1 Read Grp. Sel.
 - 2 Contact Switches
 - 3 X Position
 - 4 Y Z Position
 - 5 —
 - 6 —
 - 7 Acoustic Xpond
- Set Grp. Sel.
Bat. 1 Relay
Bat. 2 Relay
Bat. 3 Relay
LDV Reset
Camera
Acoustic Xpond

Input Output

Group 4

- 1 Read Grp. Sel.
 - 2 —
 - 3 —
 - 4 —
 - 5 —
 - 6 —
 - 7 —
- 'Set Grp. Sel.
—
—
—
—
—
—

Group 1

- 1 Read G. S.
 - 2 Compass
 - 3 —
 - 4 Heading
 - 5 —
 - 6 —
 - 7 —
- Set G. S.
Compass
Heading Latch
Heading Shift Clk,
Heading PWR.
—

Group 5 (1851)

- 1 Read G. S.
 - 2 —
 - 3 —
 - 4 CLR
 - 5 Port Status
 - 6 Port A
 - 7 Port B
- Set G. S.
—
—
CLR
Port Control
Port A] Not
Port B Used

Group 2

- 1 Read G. S.
 - 2 A/D Low 4 bits
 - 3 A/D High 8 bits
 - 4 —
 - 5 —
 - 6 —
 - 7 Relay Sense
- Set G. S.
Mux + A/D Control
Set Data Request
—
—
Circ. Pump Control (PWR)
Relay Control

Group 6 (charts)

- 1 Read G. S.
 - 2 Data 1 in
 - 3 Status 1
 - 4 Data 2 in
 - 5 Status 2
 - 6 Data 3 in
 - 7 Status 3
- Set G. S.
Data 1 out
Control 1
Data 2 out
Control 2
Data 3 out
Control 3

Group 3

- 1 Read Grp. Sel.
 - 2 —
 - 3 —
 - 4 —
 - 5 —
 - 6 —
 - 7 —
- Set Grp. Sel.
—
—
—
—
—
—

Group 7

- 1 Read Grp. Sel
 - 2 —
 - 3 —
 - 4 —
 - 5 —
 - 6 —
 - 7 —
- Set Grp. Sel.
—
—
—
—
Halt (suicide)
Memory Protect,

Input Output

WOODS

CONTRACT NO

BY N. E.

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

Input

t Grp. Sel.

Other 1806 'I/O'

EF1 —
 EF2 Compass + A/D
 EF3 Sea Data Recorder
 EF4 UT4

Q UT4, Mem. Protect, Interrupt Pulse

t G.S.

Control
 A] Not
 B] Used

s)

t G.S
 ta 1 out] Control
 trol 1 SAIL
 ta 2 out] LDV, PUMP
 trol 2 SAIL
 ta 3 out] UNUSED
 trol 3]

Grp. Sel.

(Suicide) Not
by Protect Used

24 Nov 86 WET
 16 Oct 84 WET
 27 July 84 WET
 REV 7 Nov 83 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE 1806A CPU I/O DECODING SEA DUCT		
CONTRACT NO. 10/82.69	CODE NO.			
BY N. E. TERRY	DATE	SIZE B	DWG. NO. SD-B004	OF REV.

2

1

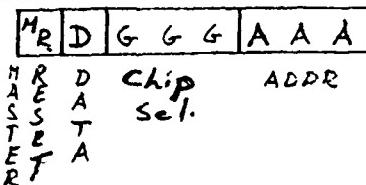
D

C

B

A

GS2-I/O7



USE OCTAL
 ↳ {
 2 XX = RESET
 1 NN = Set Function
 0 NN = CLR Function

Logical Device

I.C. Pin	#	HEX Octal #	Function	CONN. #	PA#
4	0	0 0	LDV Sail Loop	*	1 8
5	1	1 1	HEADING INDICATOR	*	1 7
6	2	2 2	—	*	1 6
7	3	3 3	—	*	1 5
(C) 9	4	4 4	TRANSMISCHMETER PWR	*	1 4
10	5	5 5	—	*	1 3
11	6	6 6	Sed 1 insert	2	8
12	7	7 7	Sed 2 retract	2	7
4	8	8 10	Sed 1 unlatch - H ₂ O Sample 1	2	6
5	9	9 11	Sed 2 insert	2	5
6	10	A 12	Sed 2 retract	2	4
7	11	B 13	Sed 2 unlatch - H ₂ O Sample 2	2	3
(C) 9	12	C 14	Opto Interrupter Drive	3	8
10	13	D 15	Bottom Switch Drive	3	7
11	14	E 16	—	—	6
12	15	F 17	—	—	5
4	6	10 2	—	3	4
5	7	11 21	—	3	3
6	8	12 22	Flume insert	4	5
7	19	13 23	Flume withdraw	4	7
(C) 9	14	14 24	Rotate CW	4	6
10	21	15 25	Rotate CCW	4	5
11	22	16 26	Suction Pump (Spare)	4	4
12	23	17 27	View Port Clean (Spare)	4	3
4	24	18 30	X+	5	8
5	25	19 31	X-	5	7
6	26	1A 32	Y+	5	6
7	27	1B 33	Y-	5	5
(C) 9	28	1C 34	Z+	5	4
10	29	1D 35	Z-	5	3
11	30	1E 36	Hydraulic Pump	6	8
12	31	1F 37	Recirculate Pump Pwr	6	7

Note I/Os to /164

I.C. Pin	DEC	H
4	32	Z
5	33	Z
6	34	Z
(C) 7	35	Z
(C) 9	36	Z
10	37	Z
11	38	Z
12	39	Z
4	40	Z
5	41	Z
6	42	Z
(C) 7	43	Z
(C) 9	44	Z
10	45	Z
11	46	Z
12	47	Z

* Supplied by uP Battery —
 All others are System Battery

Note Issued 11/28

J.C. P.i.#	DEC	HEX	OCTAL	Function	Conn.	P.i.#
4	32	20	40	Spare (was Recirculate Pump #2)	6	6
5	33	21	41	Spare	6	5
6	34	22	42	Spare (was H ₂ O sample 1)	6	4
(15) 7	35	23	43	Spare (was H ₂ O sample 2)	6	3
(13) 9	36	24	44		7	8
10	37	25	45		7	7
11	38	26	46		7	6
12	39	27	47		7	5
4	40	28	50		7	4
5	41	29	51		7	3
6	42	2A	52		8	8
(15) 7	43	2B	53		8	7
(15) 9	44	2C	54		8	6
10	45	2D	55		8	5
11	46	2E	56		8	4
12	47	2F	57		8	3

Relay/Car.
#6 cont'

24 Nov 86 WET
16 Oct 84 WET
27 July 84 WET
REV 17 July 84 RAW

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543 PROJ. 10182.69 BY W.E.T. SHEET 3 OF 3 DATE 4 NOV 86	TITLE Output Driver Decoding SEA DUCT SD-8-005
---	---

SEA DUCT-BUFFER BOARD			PULSE DRIVERS			Count/Pin
1	Compass	GS1	I/O 2	10. μ sec	24V	L1
2	Spare	-	-	-	24V	L2
3	Bat.1 RELAY	GSφ	I/O 2	160 μ sec	24V	M3
4	Bat 2 RELAY	GSφ	I/O 3	160 μ sec	24V	M4
5	Bat.3 Relay	GSφ	I/O 4	160 μ sec	24V	M5
6	LDV RESET	GSφ	I/O 5	200 μ sec.	O.C	M6
7	Camera	GSφ	I/O 6	150 μ sec	O.C	M7
8	Acoustic XPONDER ("SEND")	GSφ	I/O 7	35 μ sec	O.C	M8

SEA D

Hi Byte
(N-Z)

0	X	P
1	X	P
2	X	H
3	X	S
4	X	A
5	X	A
6	X	A
7	X	T
8	X	
9	X	
A	X	
B	X	
C	X	
D	X	
E	X	
F	X	

WOODS HOLE

W

CONTRACT NO. 101

BY W. E. T.

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

SEA DUCT - A/D + MUX DECODING

H: Byte (N X)	Lo Byte Y N
0 X Pendulum 1-Pitch (8 bit)	x 0 A/D OFF
1 X Pendulum 2-Roll (8 bit)	x
2 X μP 24V Bat (8 bit)	x 2 A/D Pwr On
3 X Sys 24V Bat (8 bit)	x 3 A/D Start Convert
4 X A/D GND (12 bit)	x
5 X A/D REF (12 bit)	
6 X A/D +SV (12 bit)	
7 X Transmissometer (12 bit)	
8 X	
9 X	
A X	
B X	
C X	
D X	
E X	
F X	

GS = 2 I/O = 2
 (use GP=X Reg)

Rev 23 Apr 86

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 ENGINEERING DEPT.
 WOODS HOLE, MA. 02543

CONTRACT NO. 10182.69

CODE NO.

BY W. E. T.

DATE 20 Nov 84

SIZE B

TITLE

Pulse Driver Decoding
 A/D, Mux Decoding
 SEA DUCT

DWG. NO. SD-B-006

OF

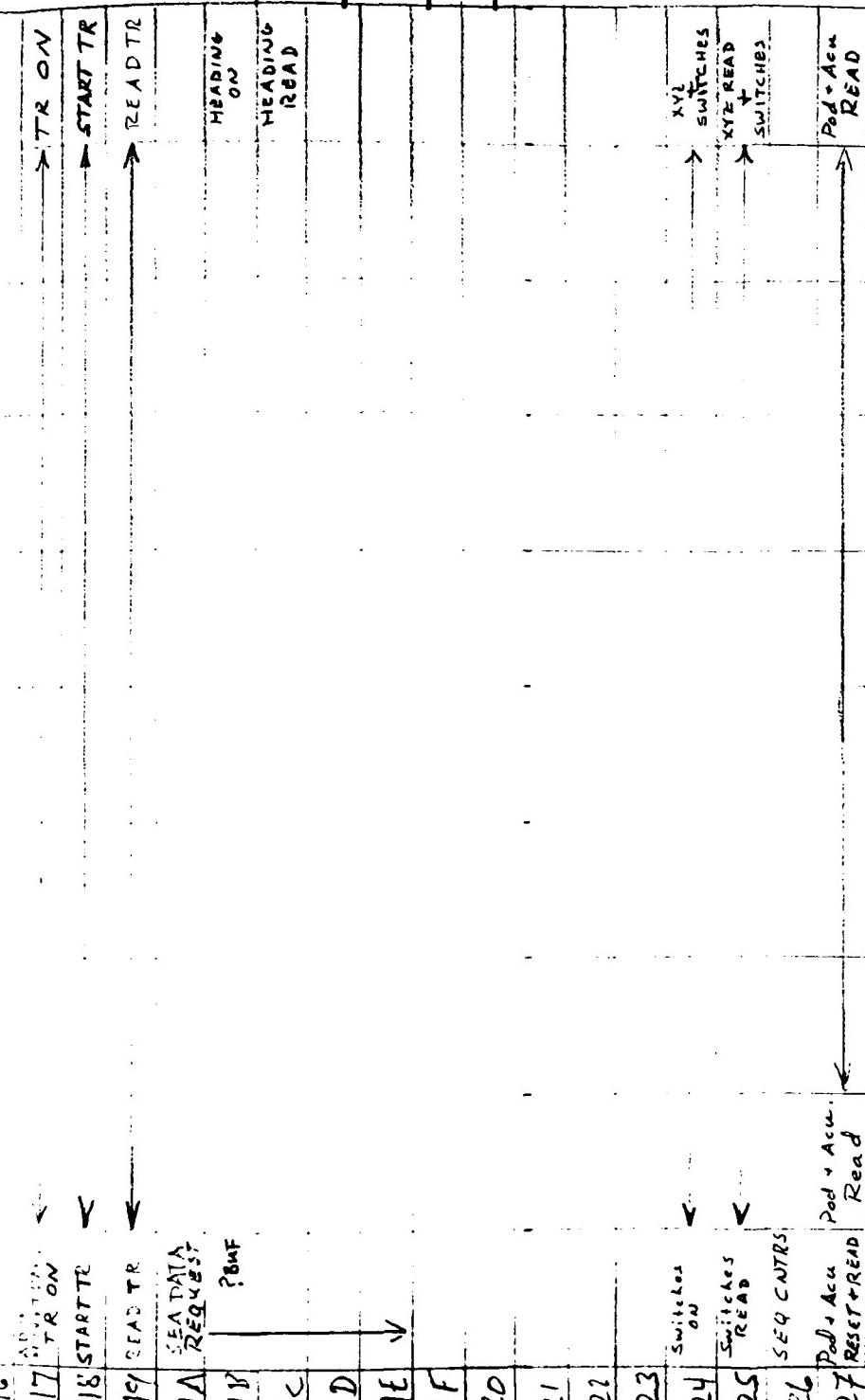
REV.

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
------	-----	-------------	------	----------



Note
This chart is a general reference. It does not represent everything done by the CPC.

REV 24 Nov. 86

WOODS HOLE OCEANOGRAPHIC INSTITUTION		TITLE	
ENGINEERING DEPT. WOODS HOLE, MA. 02543		Software Timing	
CONTRACT NO.	10/82.69	CODE NO.	SEA DUCT
BY WET	DATE 9/9/84	SIZE B	DWG. NO. SD-B-007
			OF
			REV.

2

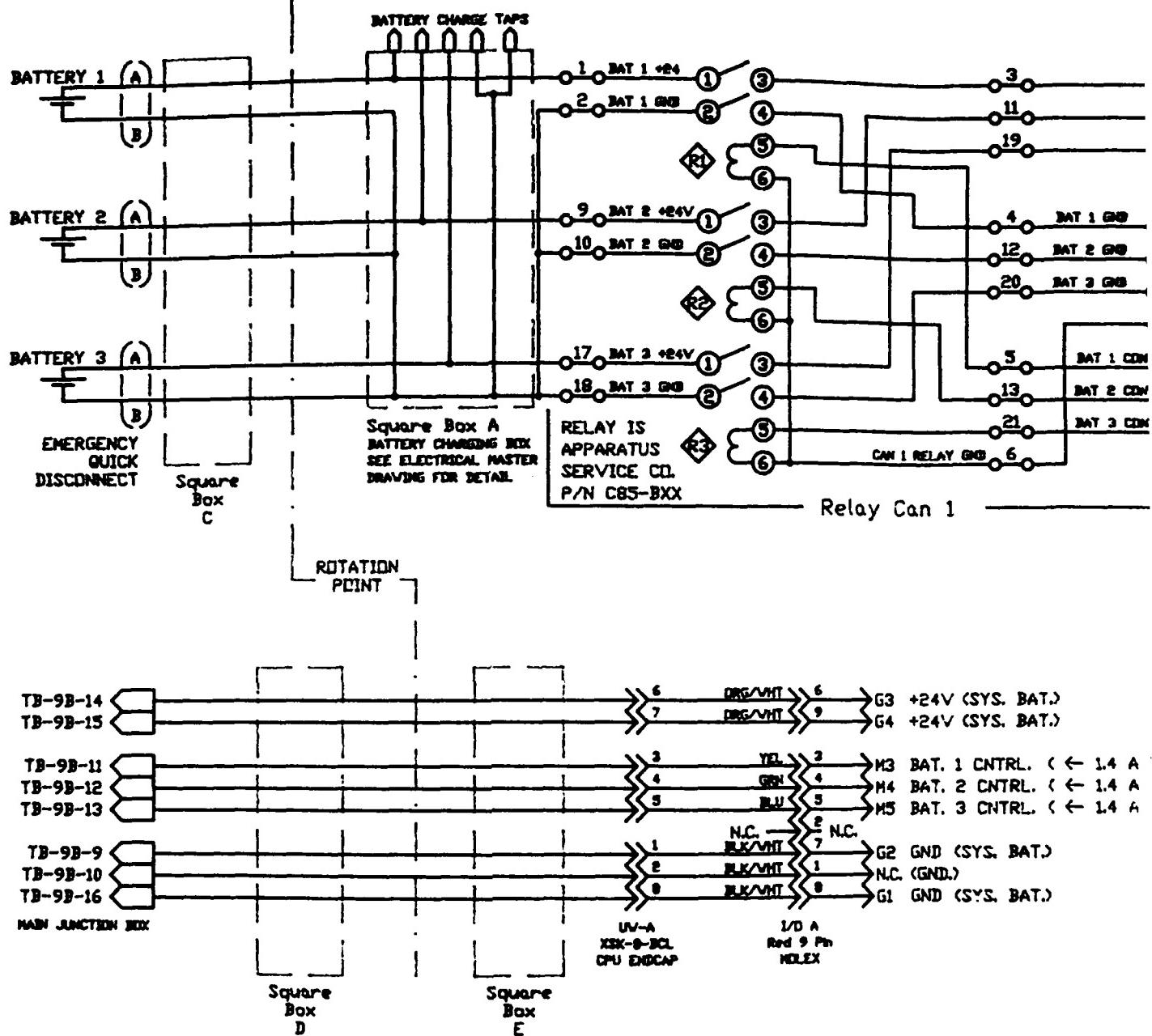
1

PIN #	FUNCTION		CIR		CIR		CIR		
	SQ DIA	34 MTR	26 MTR	SQ DIA	34 MTR	26 MTR	SQ DIA	34 MTR	26 MTR
1	1104	110 4°	EF 2	EF 1(°)					
2	110 7	110 7°	EF 3	EF 3	EF 3	EF 3	EF 3	EF 3	EF 3
3	110 3	110 3°	EF 1	EF 1	EF 1	EF 1	EF 1	EF 1	EF 1
4	110 6	110 6°	EF 4	EF 4	EF 4	EF 4	EF 4	EF 4	EF 4
5	110 2	110 2°	GND	GND	GND	GND	GND	GND	GND
6	110 5	110 5°	NC	NC	NC	NC	NC	NC	NC
7	GND	GND	652°	652°	652°	652°	652°	652°	652°
8	GND	GND	612°	612°	612°	612°	612°	612°	612°
9	5+	5+	110 3°	110 3°	110 3°	110 3°	110 3°	110 3°	110 3°
10	5-	5-	BL	BL	BL	BL	BL	BL	BL
11	EF4	EF4	NC	NC	NC	NC	NC	NC	NC
12	NC KEP	65 3°	B2L	B2L	B2L	B2L	B2L	B2L	B2L
13	EF3R	EF3R	SC 0	SC 0	SC 0	SC 0	SC 0	SC 0	SC 0
14	EF3	EF3	B3L	B3L	B3L	B3L	B3L	B3L	B3L
15	A7	A7	728°	728°	728°	728°	728°	728°	728°
16	EF2	EF2	534L	534L	534L	534L	534L	534L	534L
17	A6	A6	65D 0	65D 0	65D 0	65D 0	65D 0	65D 0	65D 0
18	EF1	EF1	BS2	BS2	BS2	BS2	BS2	BS2	BS2
19	A5	A5	MK5°	MK5°	MK5°	MK5°	MK5°	MK5°	MK5°
20	N2	N2	NC KEP	NC KEP	NC KEP	NC KEP	NC KEP	NC KEP	NC KEP
21	A4	A4	B6 0	B6 0	B6 0	B6 0	B6 0	B6 0	B6 0
22	N1	N1	CC15	CC15	CC15	CC15	CC15	CC15	CC15
23	A3	A3	B5 0	B5 0	B5 0	B5 0	B5 0	B5 0	B5 0
24	N0	N0	NC KEP	NC KEP	NC KEP	NC KEP	NC KEP	NC KEP	NC KEP
25	A2	A2	B4 0	B4 0	B4 0	B4 0	B4 0	B4 0	B4 0
26	G52	G52	NC	NC	NC	NC	NC	NC	NC
27	A1	A1	B3 0	B3 0	B3 0	B3 0	B3 0	B3 0	B3 0
28	G51	G51	NC	NC	NC	NC	NC	NC	NC
29	A0	A0	B2 0	B2 0	B2 0	B2 0	B2 0	B2 0	B2 0
30	G50	G50	MRD 0	MRD 0	MRD 0	MRD 0	MRD 0	MRD 0	MRD 0
31	G7	G7	B1 0	B1 0	B1 0	B1 0	B1 0	B1 0	B1 0
32	WATT	WATT	TPB 0	TPB 0	TPB 0	TPB 0	TPB 0	TPB 0	TPB 0

<u>24</u>	<u>65.1</u>	<u>112.2</u>	<u>NC</u>	<u>NC</u>
29	40	112.2	NC	NC
30	65.0	112.2	NC	NC
31	87	81°	NC	NC
32	Watt	123°	NC	NC
33	86	80°	17	NC
34	CLR	7.21	15	NC
35	85		7.10	25
36	SCB		7.8	23
37	84		NC	26
38	SCB		7.8	24
39	83		34	NC
40	Q		32	NC
41	82	65.0°	30	17
42	MRD	65.1°	28	15
43	81	65.2°	26	13
44	MRT	65.3°	46	12
45	80	110.2°	5	NC
46	65.3	110.3°	3	9
47	TPB	110.4°	1	NC
48	DMA OUT	110.5°	6	NC
49	TPA	110.6°	4	NC
50	DMA IN	110.7°	2	NC
		None	26, 28	6, 11
		NC KEY	12	None

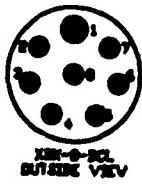
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/182.69 BY ARD
SHEET 1 OF 1 DATE 4 NOV 63

TITLE Computer Ribbon Conn.
PIN/FUNCT. Cross Ref. SEA DUCT



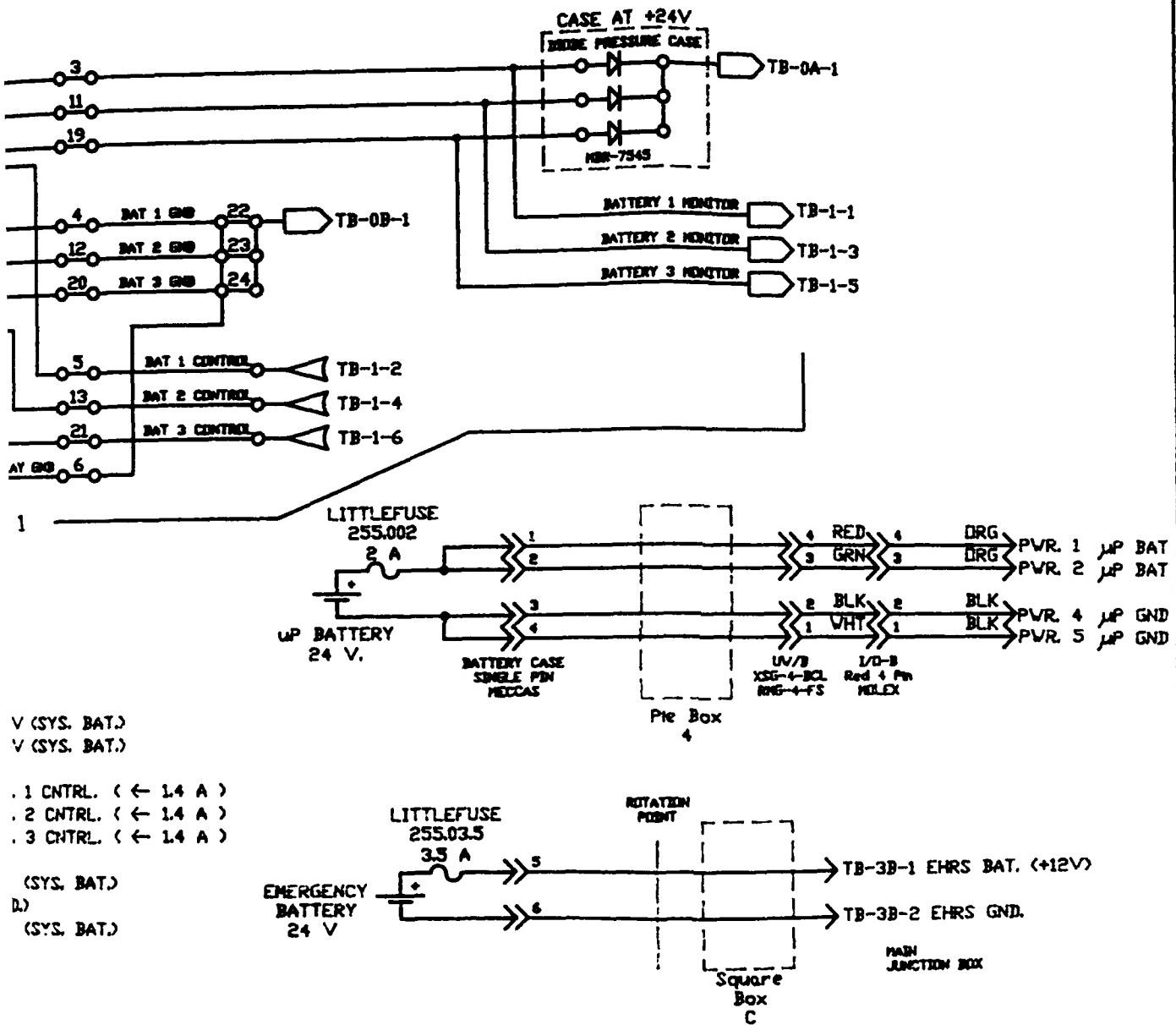
18-4, 18-8
Color Code

VHT = 1
 BLK = 2
 GRN = 3
 RED = 4
 DRG = 5
 BLU = 6
 VHT/BLK = 7
 RED/BLK = 8



WOODS HOLE DC
APPLIED ENCL
WOODS

CONTRACT NO. 10/8269
BY W.E. TERRY



WOODS HOLE OCEANOGRAPHIC INSTITUTION
APPLIED ENGINEERING LABORATORY
WOODS HOLE, MA. 02543

TITLE UP BATTERY, SYSTEM BATTERY
AND, EMERGENCY BATTERY
SYSTEMS

SEA DUCT

TRACT NO. 10/8269

CODE NO.

DWG. NO. SD-8009

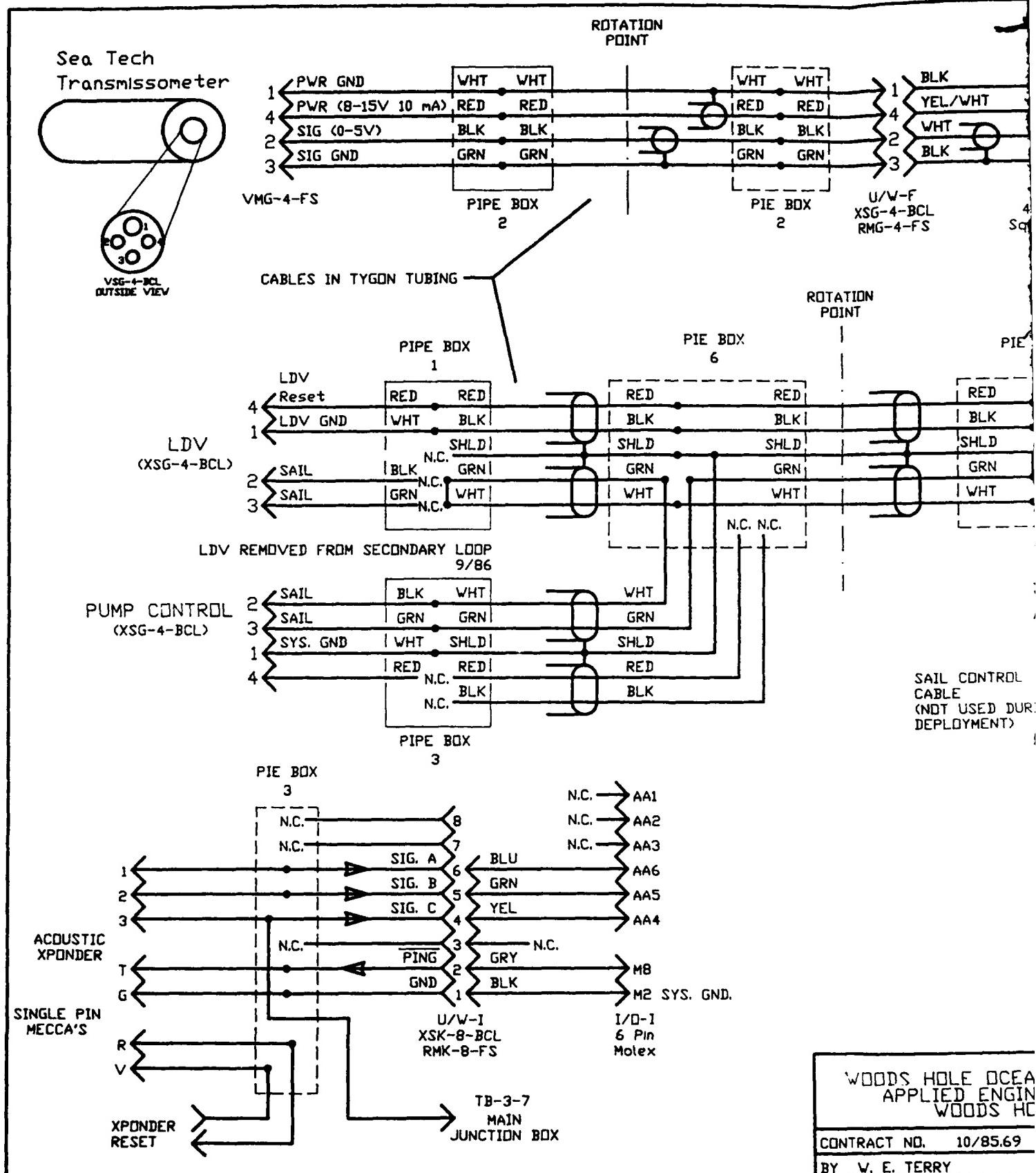
OF

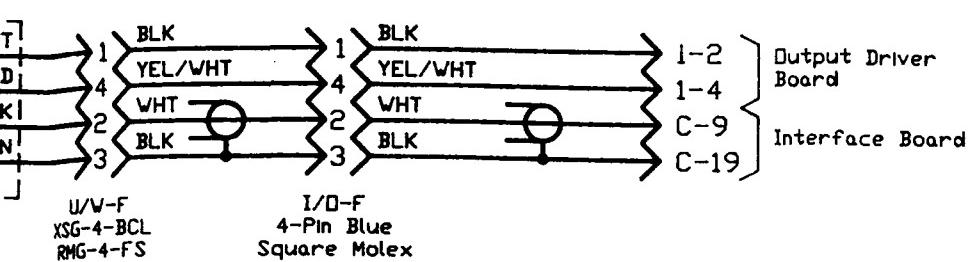
REV. 24 MAR 87

W.E. TERRY

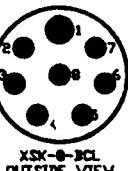
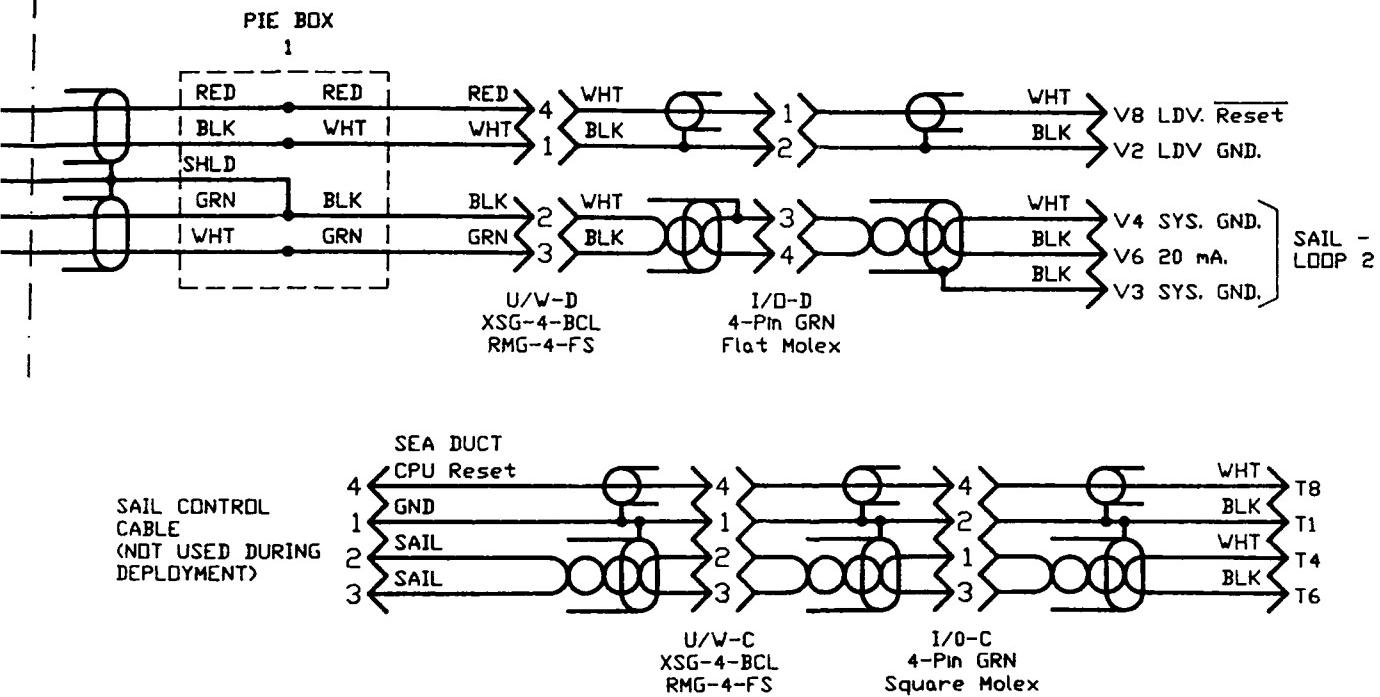
DATE 1 AUG 84

SIZE B





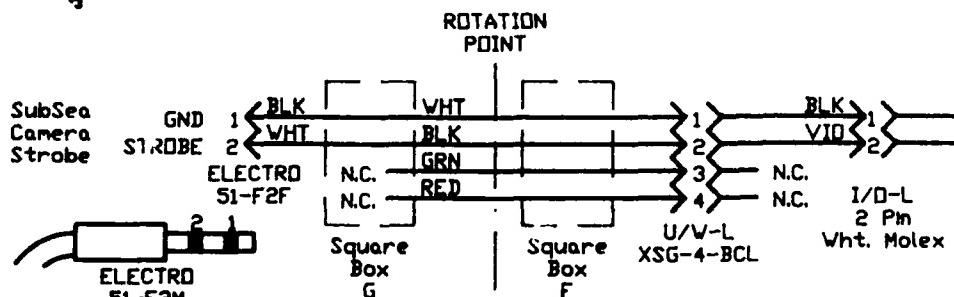
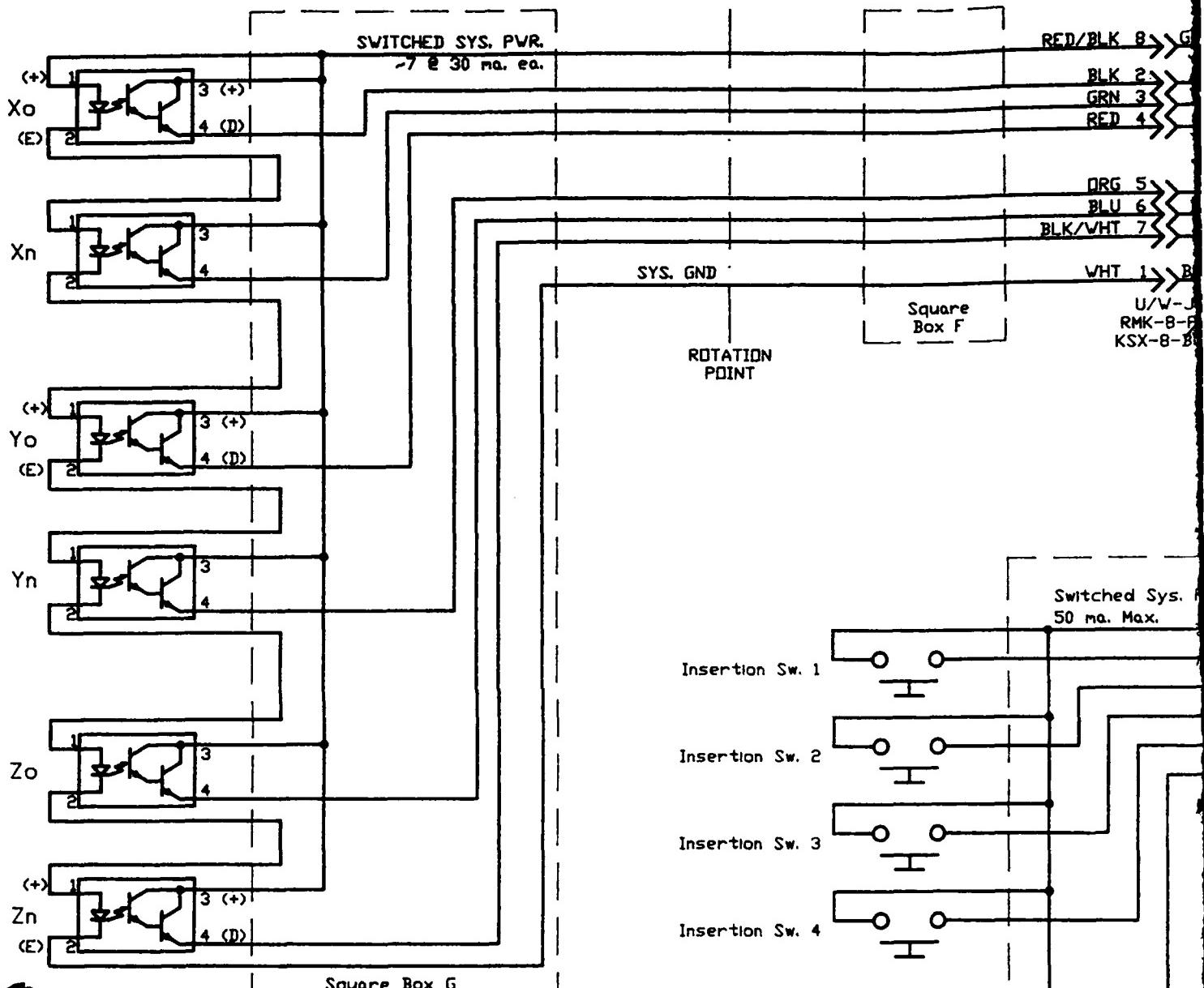
ROTATION POINT



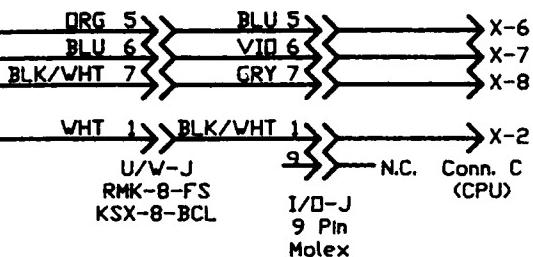
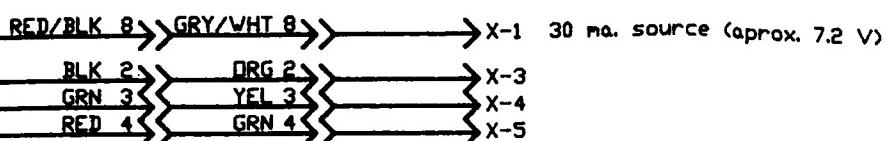
18-4, 18-8
Color Code

WHT	=	1
BLK	=	2
GRN	=	3
RED	=	4
ORG	=	5
BLU	=	6
WHT/BLK	=	7
RED/BLK	=	8

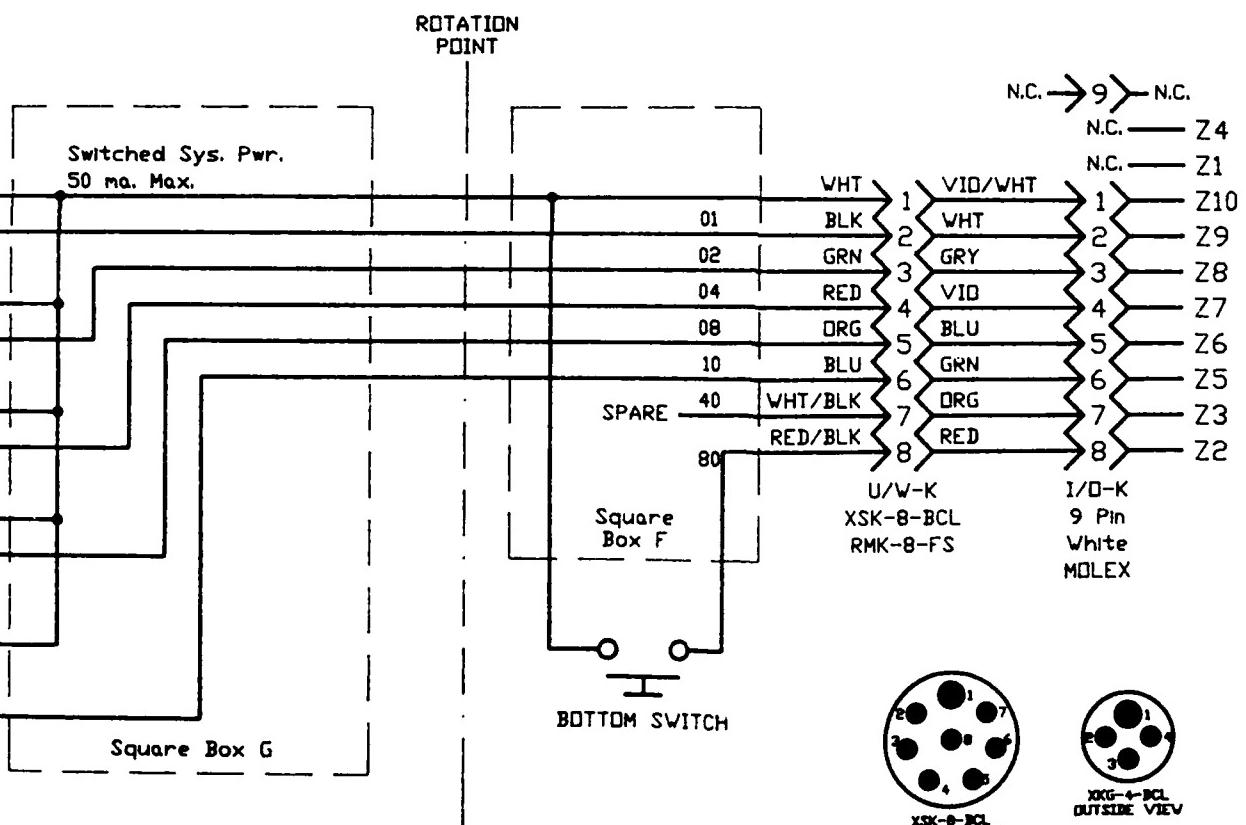
WOODS HOLE OCEANOGRAPHIC INSTITUTION APPLIED ENGINEERING LABORATORY WOODS HOLE, MA. 02543		TITLE		SAIL, TRANSPONDER, AND TRANSMISSOMETER --- EXTERNAL CONNECTIONS SEA DUCT			
INTRACT NO. 10/85.69	CODE NO. W. E. TERRY	DATE 26 JUL 85	SIZE B	DWG. NO. SD-B-010	OF	REV. 02 DEC 86	



WOODS HOLE OCEANOGRAPHIC
APPLIED ENGINEER
WOODS HOLE,
CONTRACT NO. 10/85.69
BY W. E. TERRY



18-4, 18-8
Color Code
WHT = 1
BLK = 2
GRN = 3
RED = 4
DRG = 5
BLU = 6
WHT/BLK = 7
RED/BLK = 8



WOODS HOLE OCEANOGRAPHIC INSTITUTION
APPLIED ENGINEERING LABORATORY
WOODS HOLE, MA. 02543

TITLE
OPTO INTERRUPTERS, CAMERA
SENSE SWITCHES

EXTERNAL WIRING SEA DUCT

TRACT NO. 10/85.69

CODE NO.

V. E. TERRY

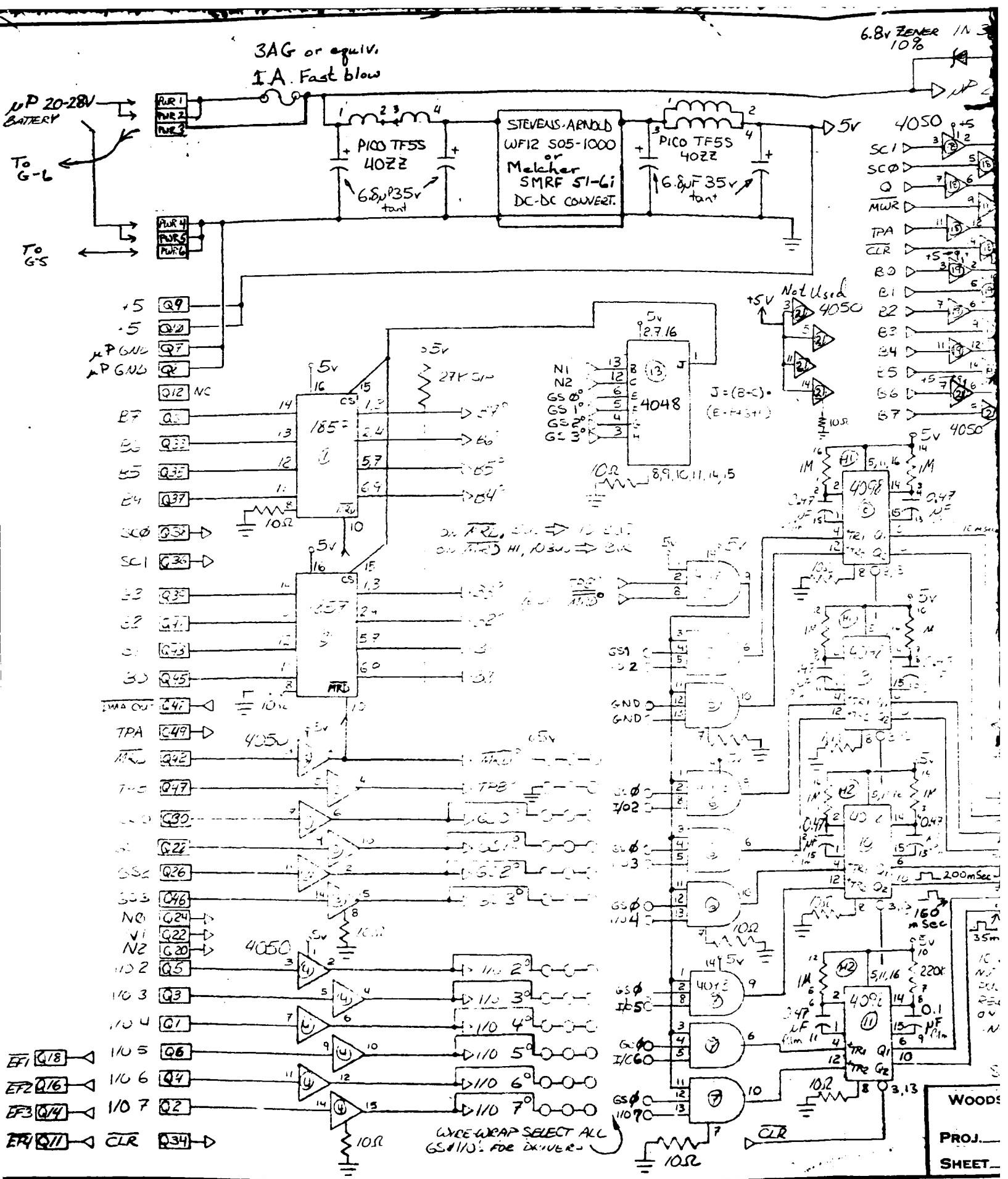
DATE 1 NOV. 83

SIZE B

DWG. NO. SD-B011

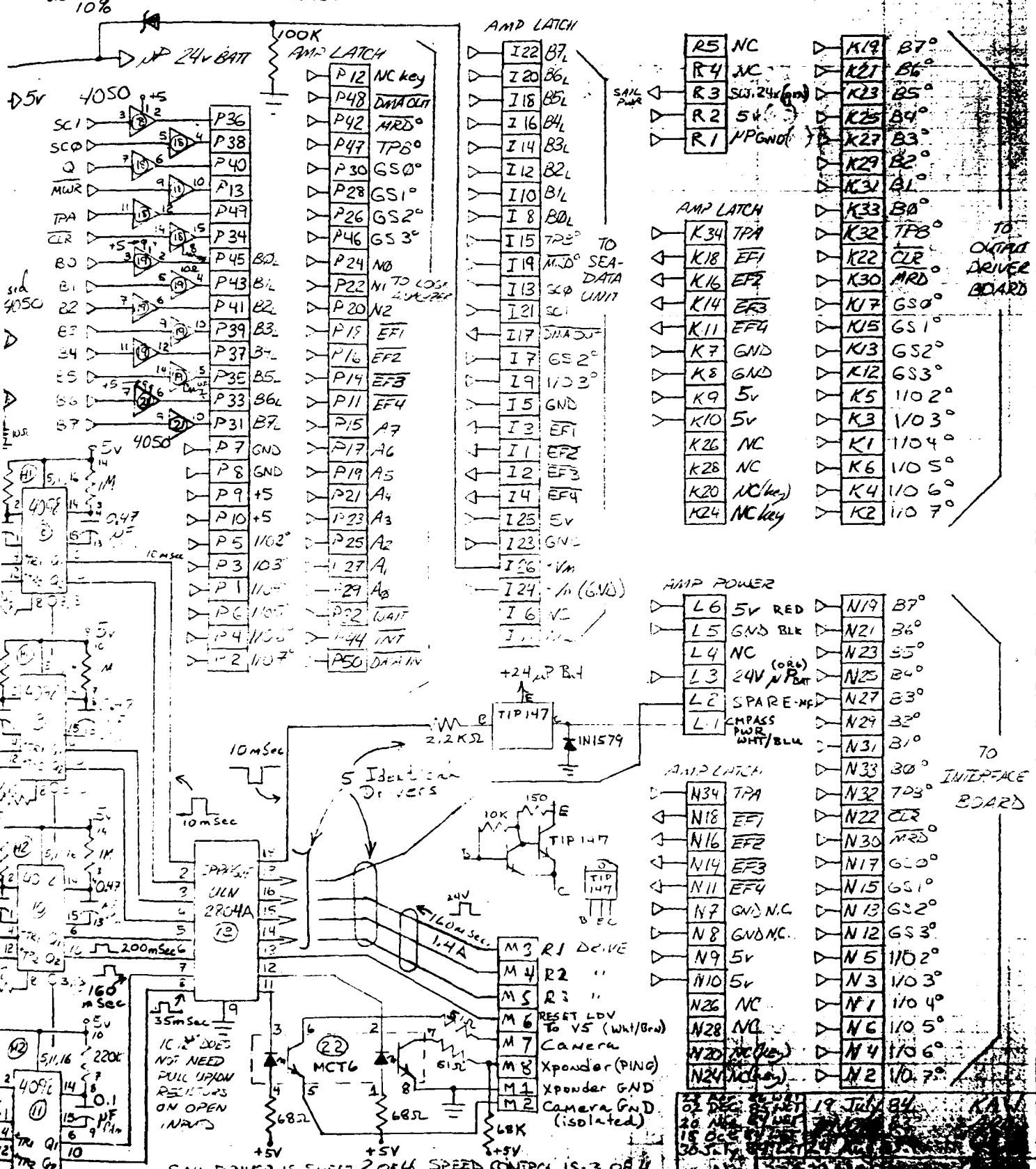
DF

REV.23 APR 86



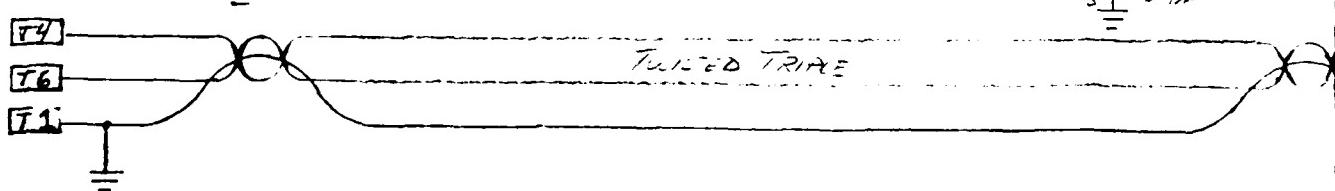
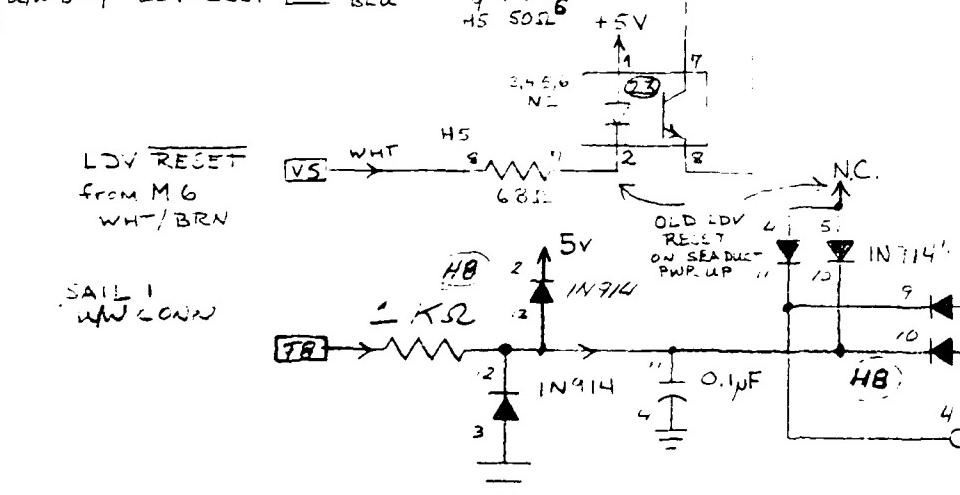
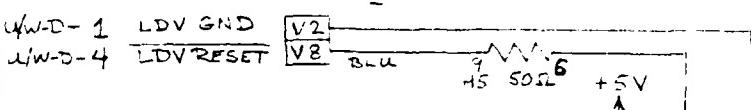
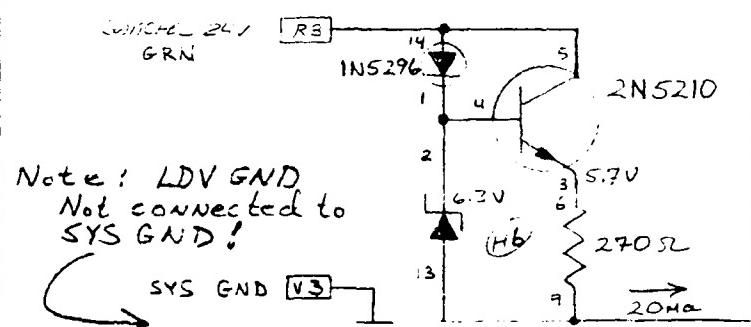
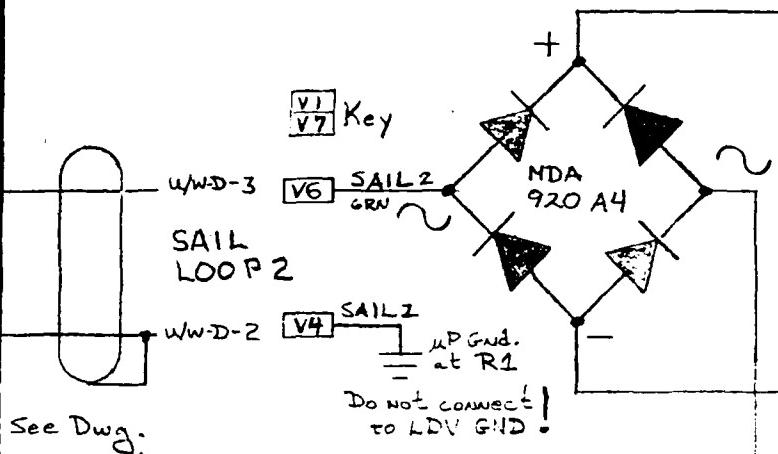
WOODS
PROJ. __
SHEET __

6.8v ZENER IN 3999A 10 Watt
10%

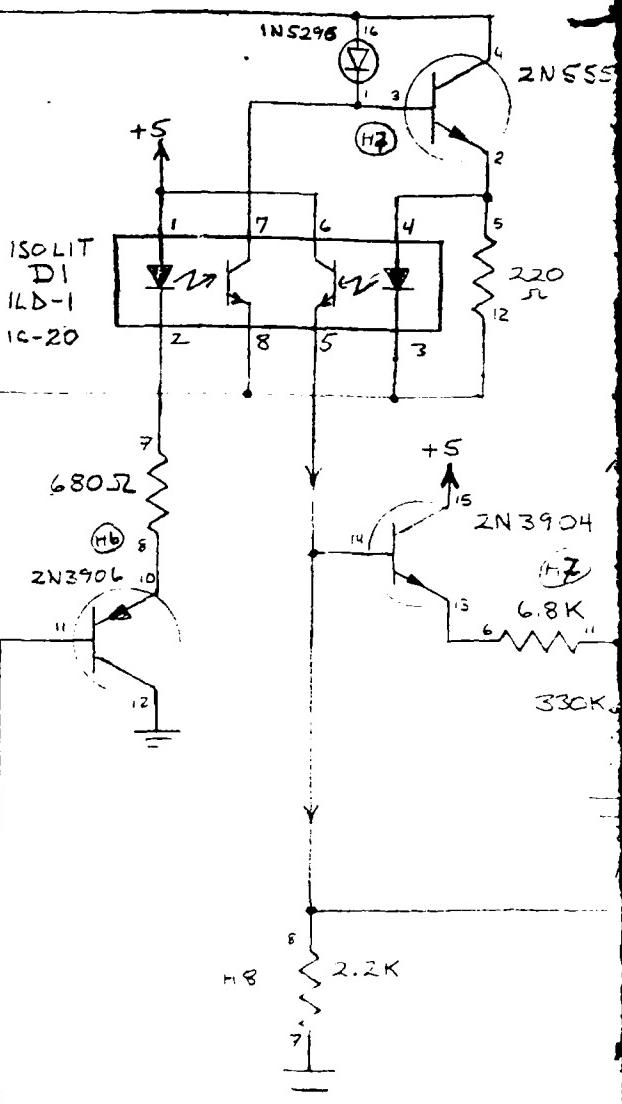


SAIL DRIVER IS SHEET 2 OF 4, SPEED CONTROL IS 3 OF 4

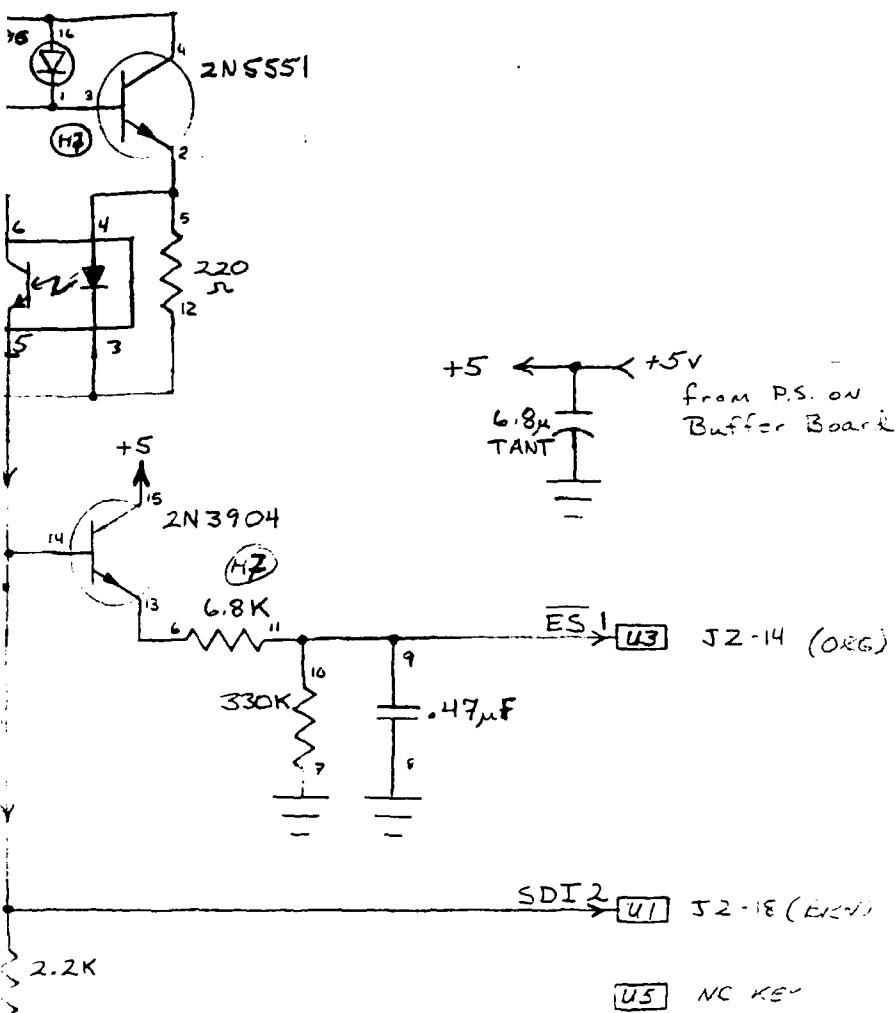
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543



T2 Key



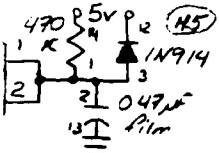
Woo
PROJ.
SHEET



SDI 2 → [U2] J2-16 (VEL)

RESET → [S8]

CPU
J4-8
J4-5 NC.
J4-5&7 Key



SAIL1

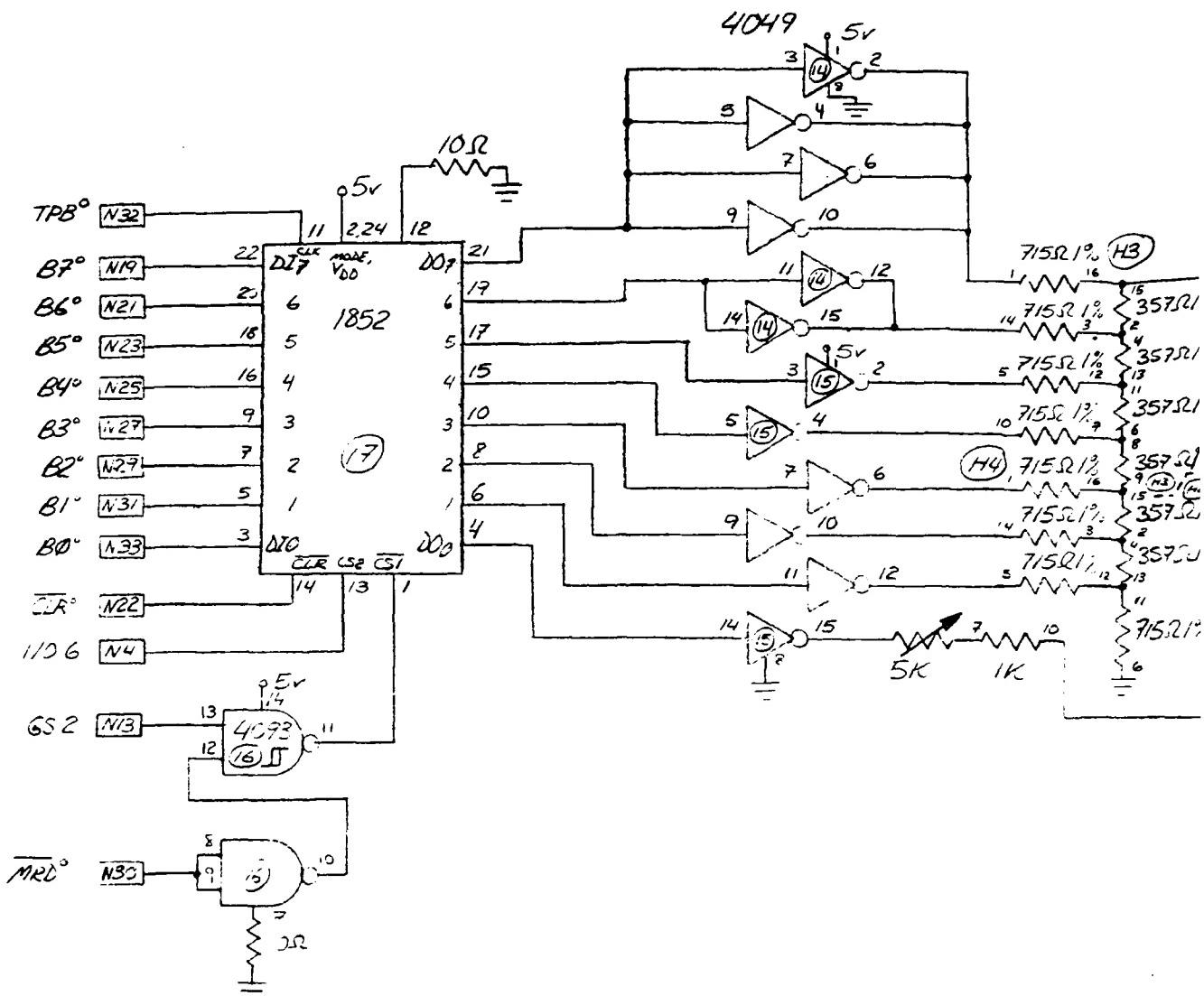
[S4] J4-4
[S6] J4-6
[S9] J4-2



20 Nov 84	84	WET
15 Oct 84	84	DCT
31 July 84	84	KAW
30 Sept 84	84	WET

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82.69 BY WEF
SHEET 2 OF 4 DATE 11 Apr 83

TITLE
Buffer Board, SAIL1
SD-B013



$2.75 \text{ mA} = \Phi \text{ Motor Speed}$

? $\text{mA} = \text{F.S. Motor Speed}$ (trim on motor control)

.5v

TO OUT-ISOLATOR ON
MOTOR CONTROLLER

Note: * Does not go to a connector.
Stops at carrier H3 pin 16.

(H3)

15
4
357.21%
13
11
357.21%
6
8
357.21%
9 (2) 100
15
357.21%
2
357.21%
13
11
75.21%
6

FIVE P ~
2.75 mA F.S.
REF. 5000

Note: Circuit no longer used, but wiring still in place!
IC's 14, 15, 17 and parts carriers H3, H4 have been removed.

Speed control PWR via Output Driver Board

Speed control in separate SAIL controlled housing.

24 Nov 86 WET

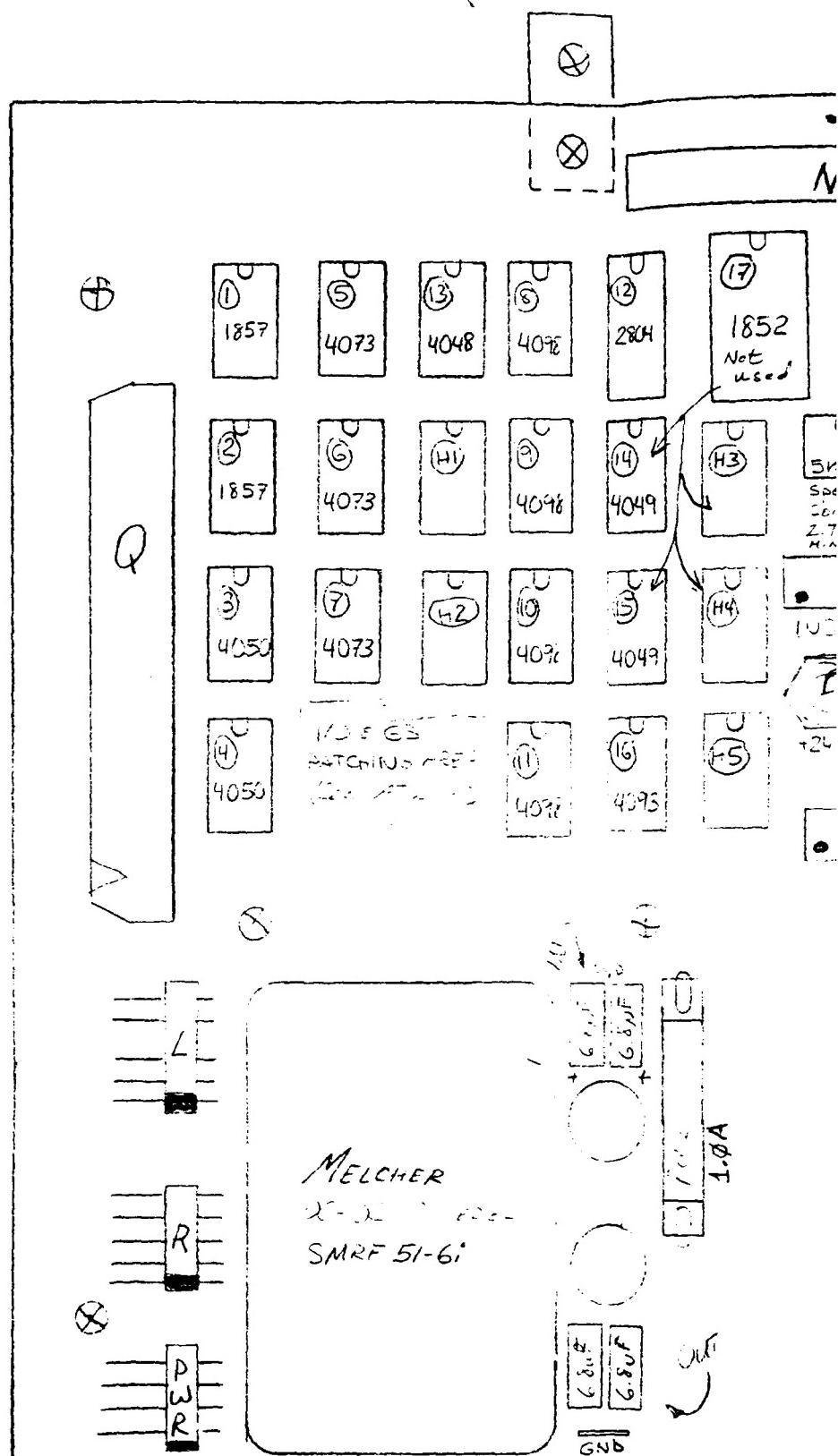
REV 1 Mar 86 WET

REV 12 July 84 KAW

REV 23 Aug 85

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Mass. 02543
PROJ. 10187.69 BY AED
SHEET 3 OF 4 DATE 4 Aug 83

TITLE
Buffer Board -
Circ. Pump Control
SEA DUCET



W
 PR
 SH

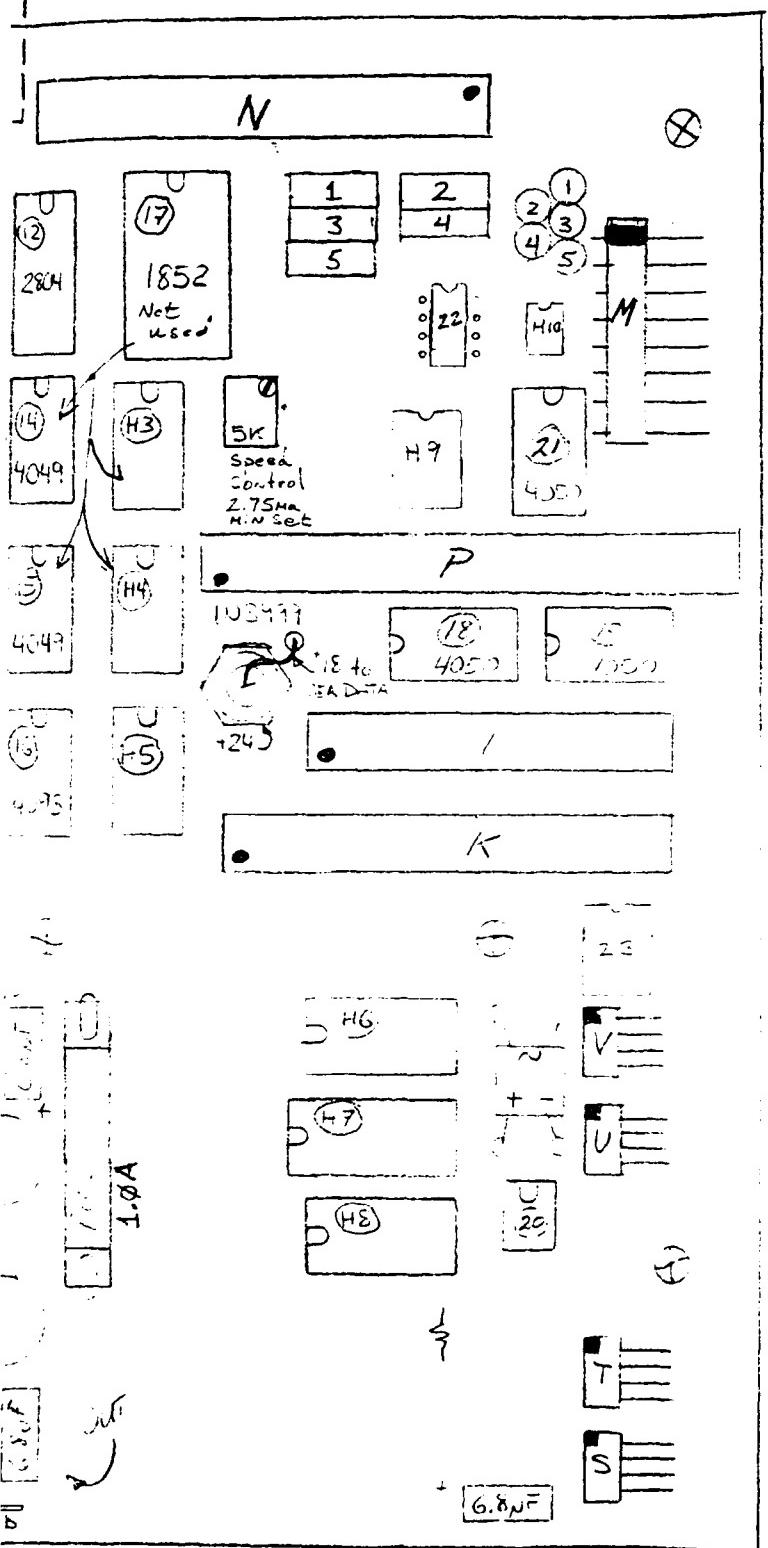
N

5K
 Sae
 200
 2.7
 H.A.
 100

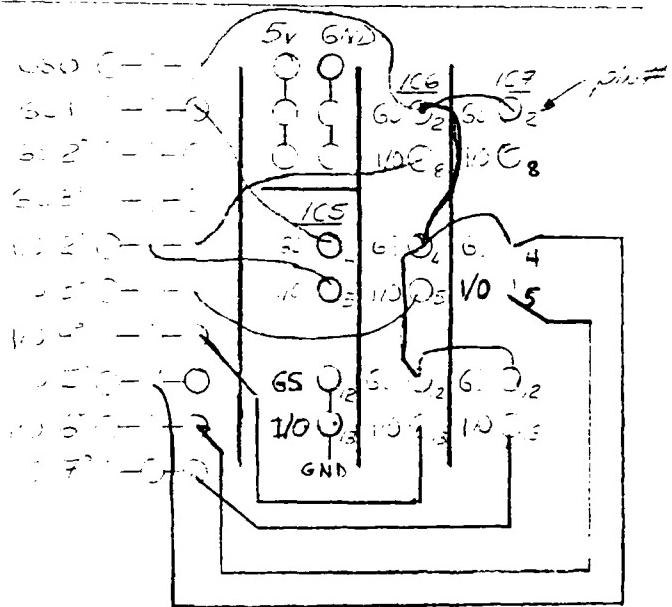
+20

100
 100

0



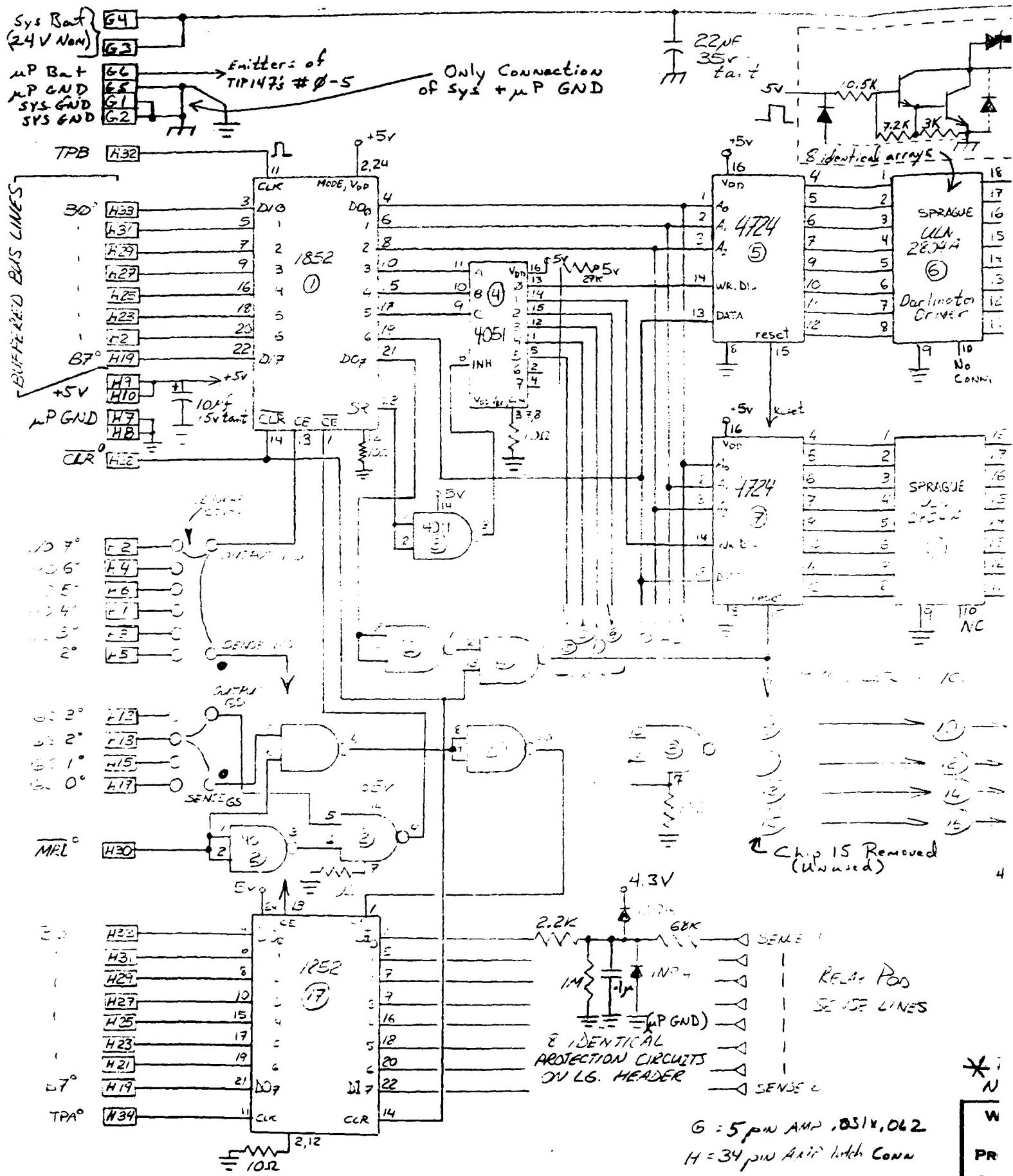
100:32 EATING PRESS

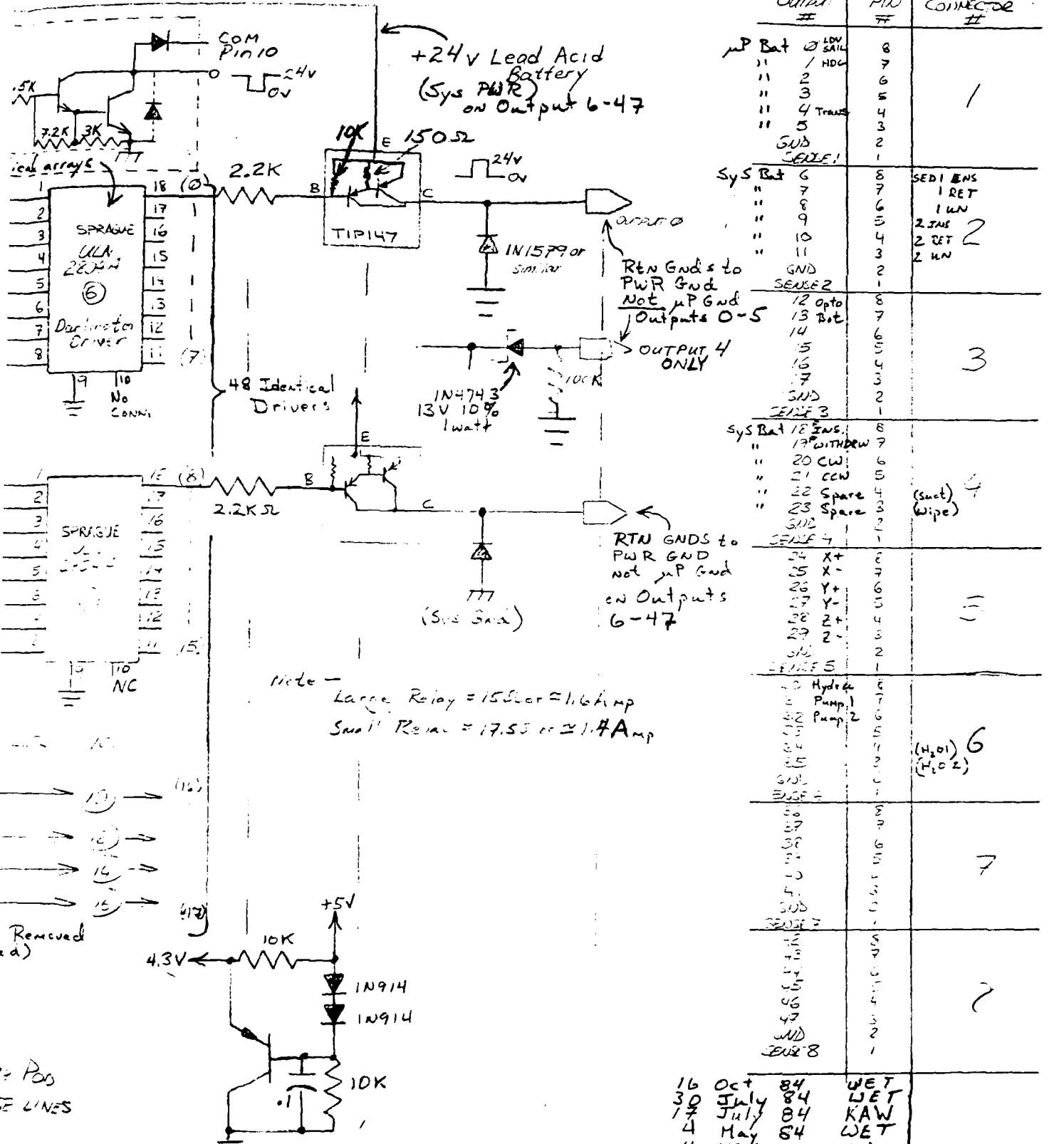


24 Nov 86 WET
02 DEC 85 WET
15 Oct 84 WET
30 July WET
Rev 19 July WET

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82 .67 BY APD
SHEET 4 OF 4 DATE 26 Sep 83

TITLE
Buffer Board - Parts Layout
SEA DUCT
SD-B015



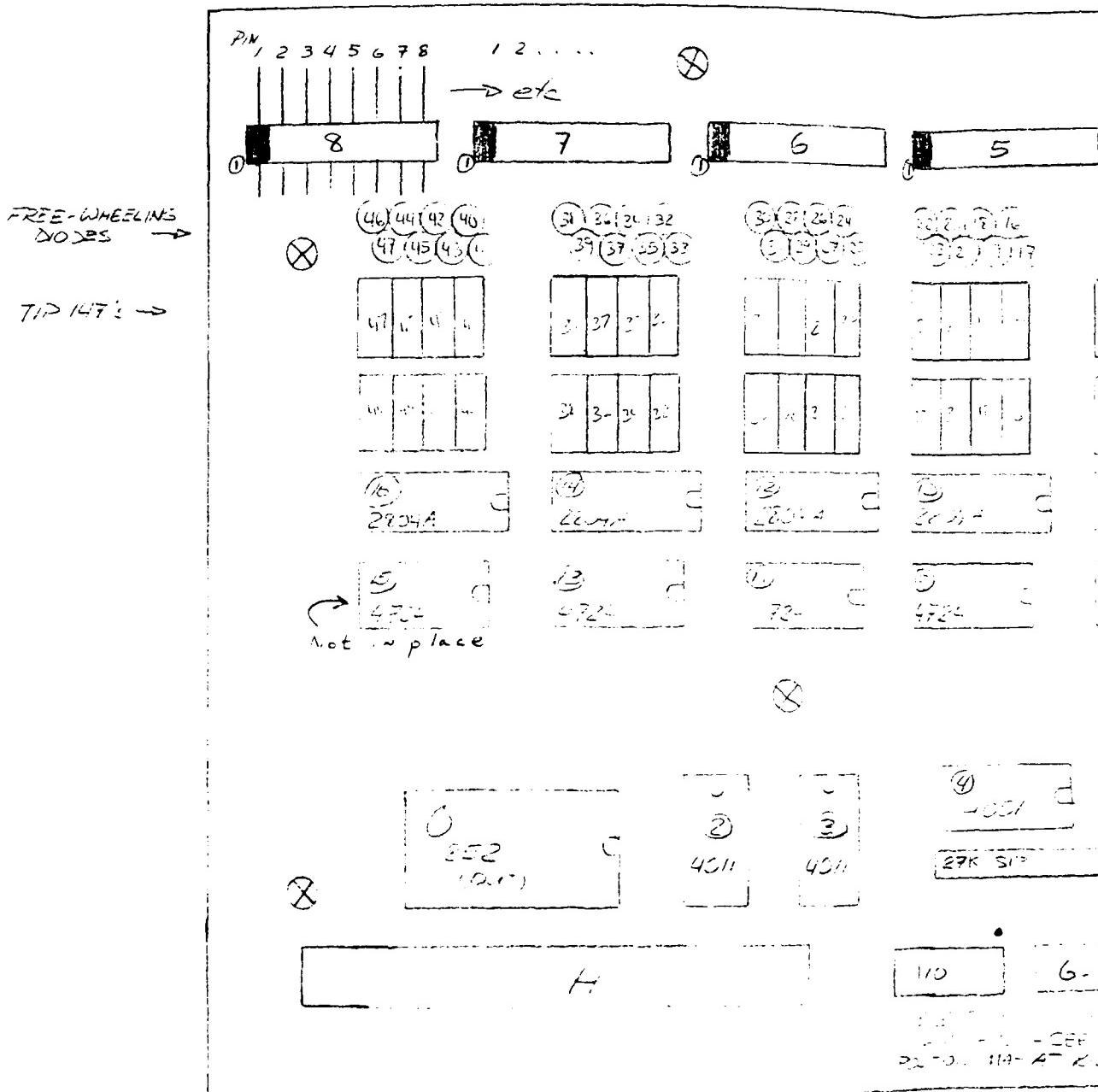


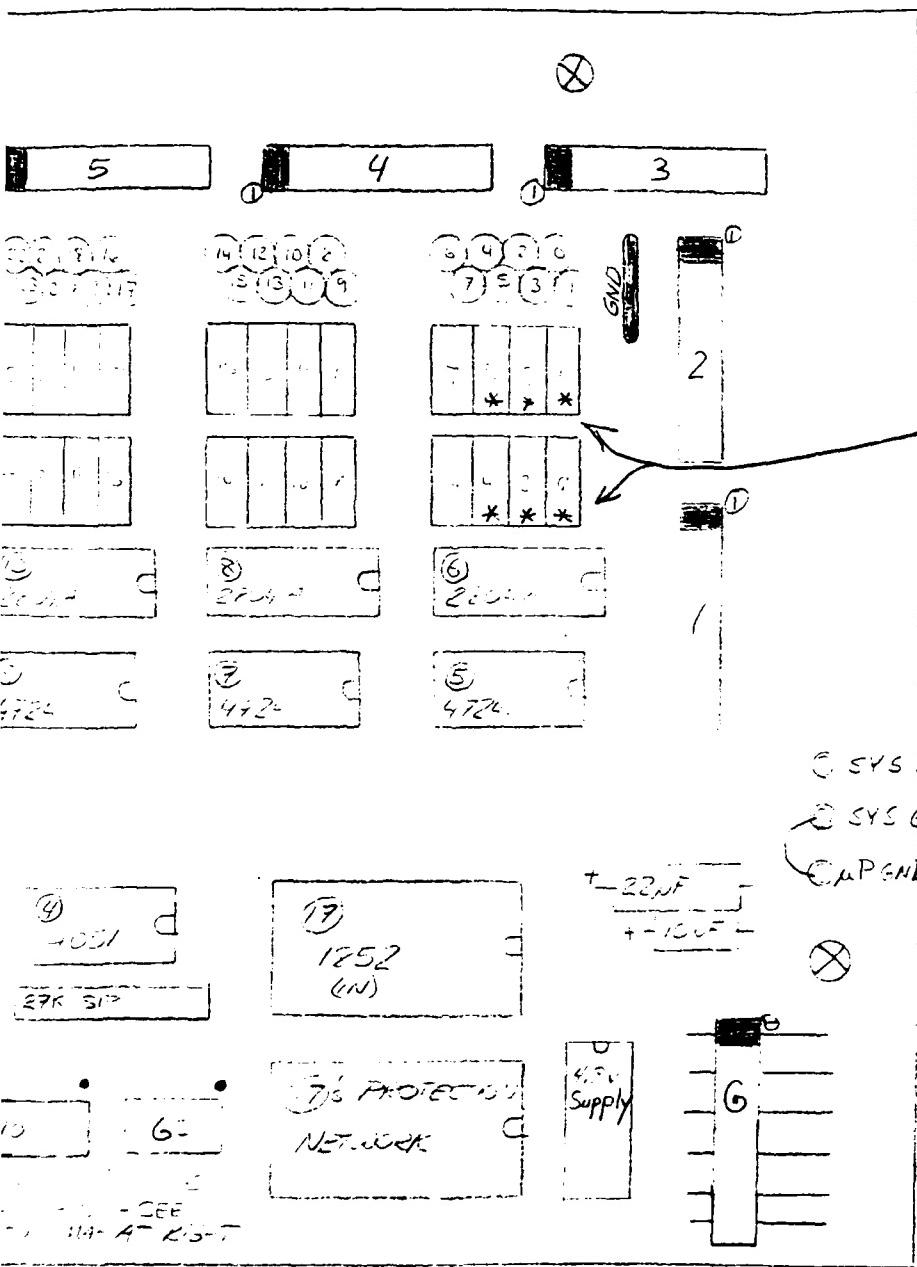
* POWER 24V COMES FROM POWER BATTERIES,
NOT μP BATTERIES - BE WARNED

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02548
PROJ. 10/82.69 BY ARD
SHEET 1 OF 3 DATE 17 Feb 83

REV 3 AUG 83 ARD REV 24 NOV 86 WET

TITLE: OUTPUT DRIVER BOARD
SEA DUCT
SD-B016





① SYS BAT (-24)

② SYS GND

③ UPS GND

~~UPS SELECTED INPUT~~

110°F SENSE 1

110°F SENSE 2

110°F SENSE 3

110°F SENSE 4

65°F SENSE 1

65°F SENSE 2

65°F SENSE 3

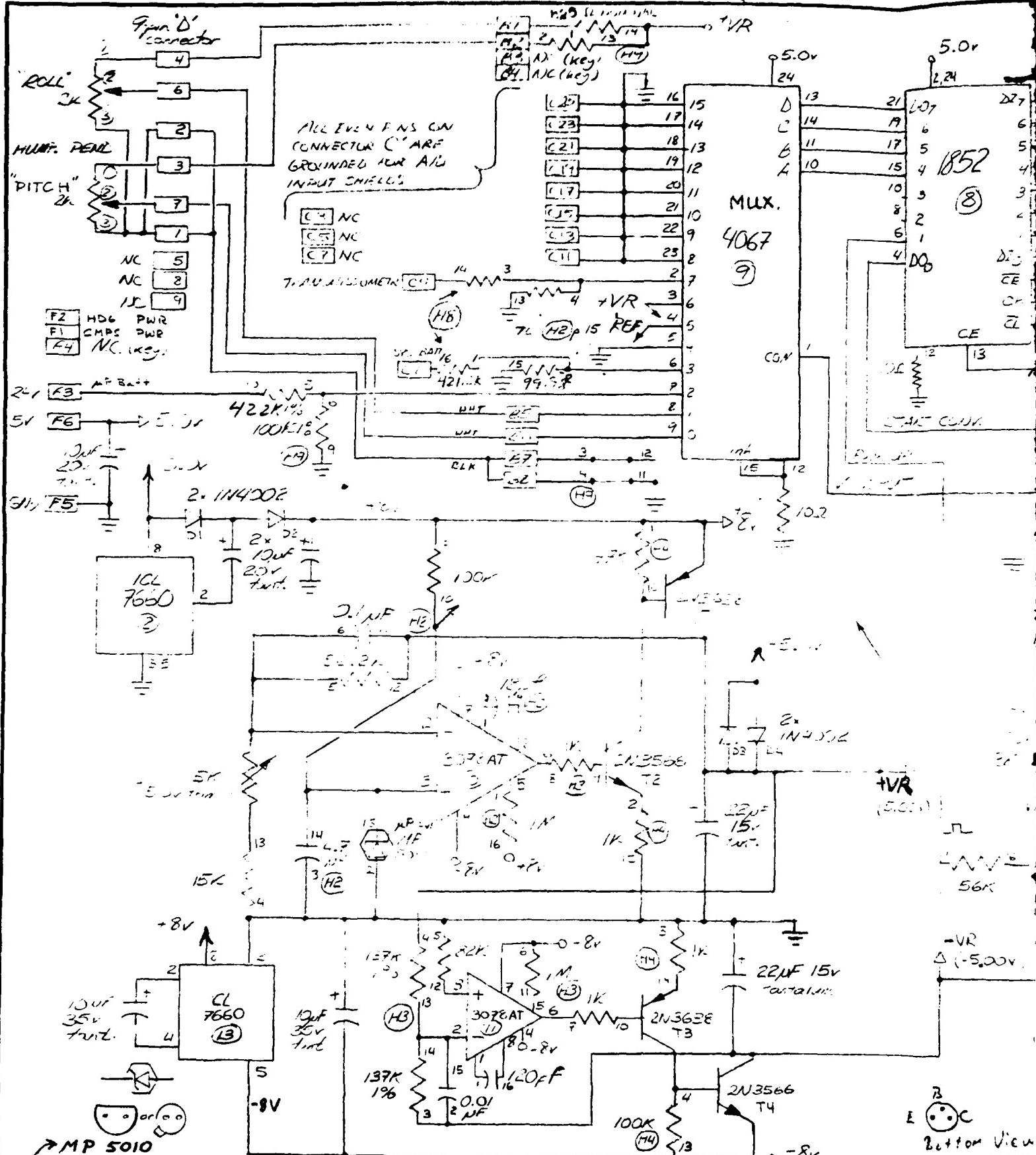
65°F SENSE 4 SENSE GS

24 Nov 86 WET
19 July 84 WET
REV 12 July 84 KAW
REV 21 Oct 83 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 012269 BY API
SHEET 2 OF 3 DATE 26 SEP 83

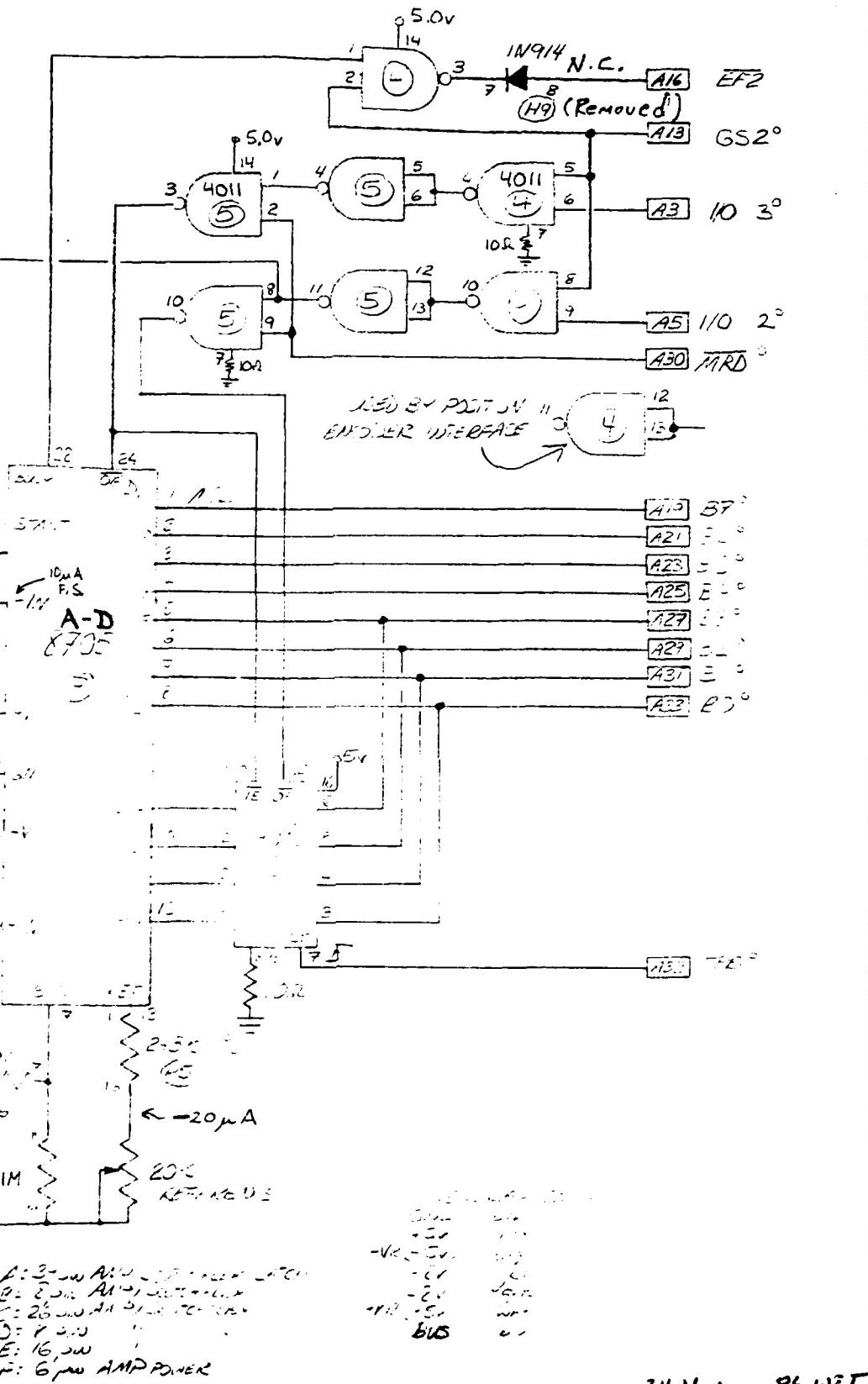
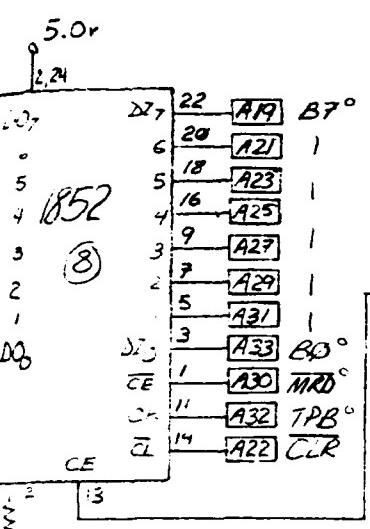
TITLE

Output Drivers Board - Parts Layout
SEA DUCT
SD-B-017



→ Je Power SYSTEMS (MTI N. torola)

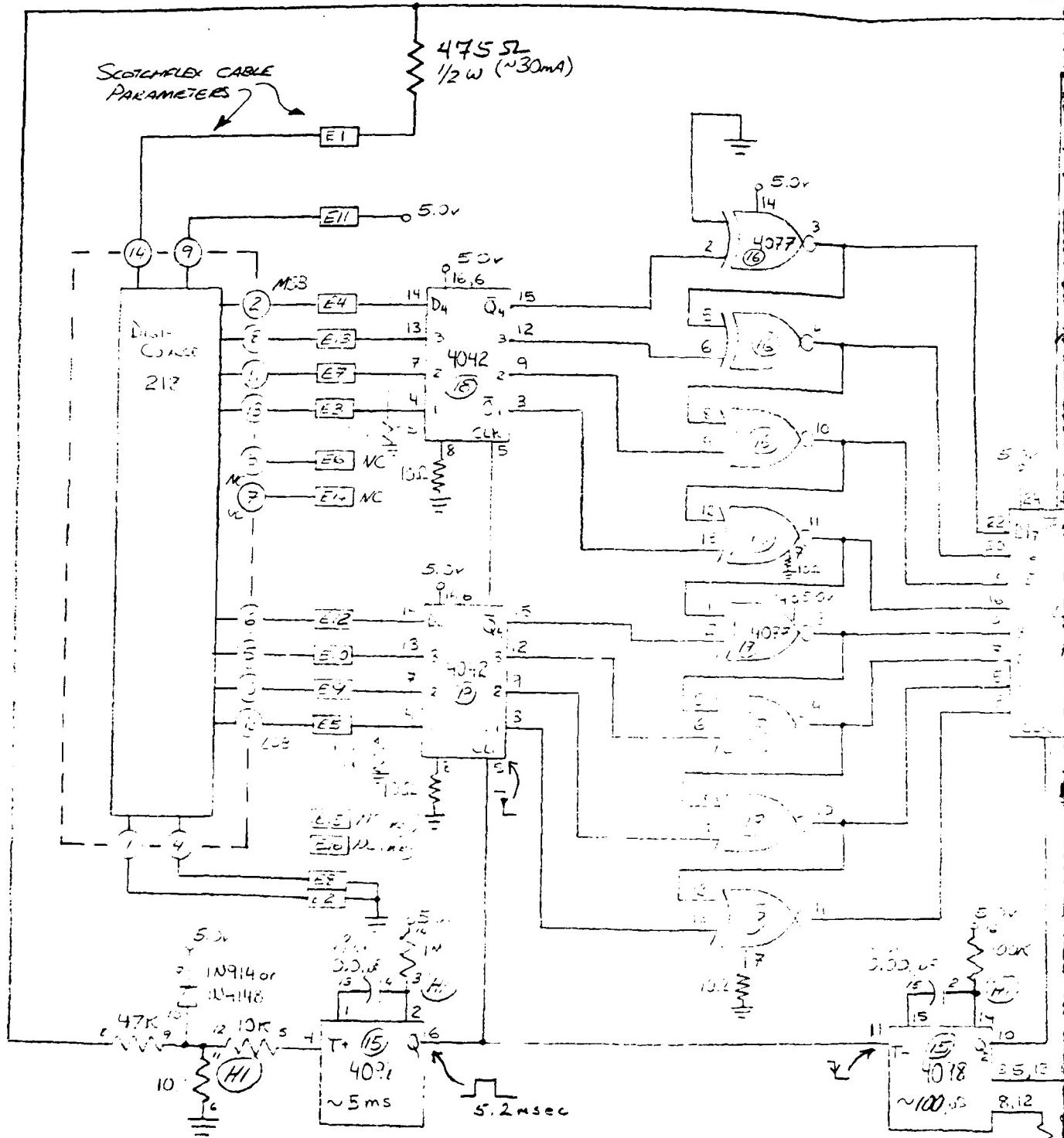
W
PR
SH



B
Bottom View.

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82.69 BY ARD
SHEET 1 OF 4 DATE 24 Feb 83

TITLE Interface Board
A/D, Voltage Converter
SEA DUCT

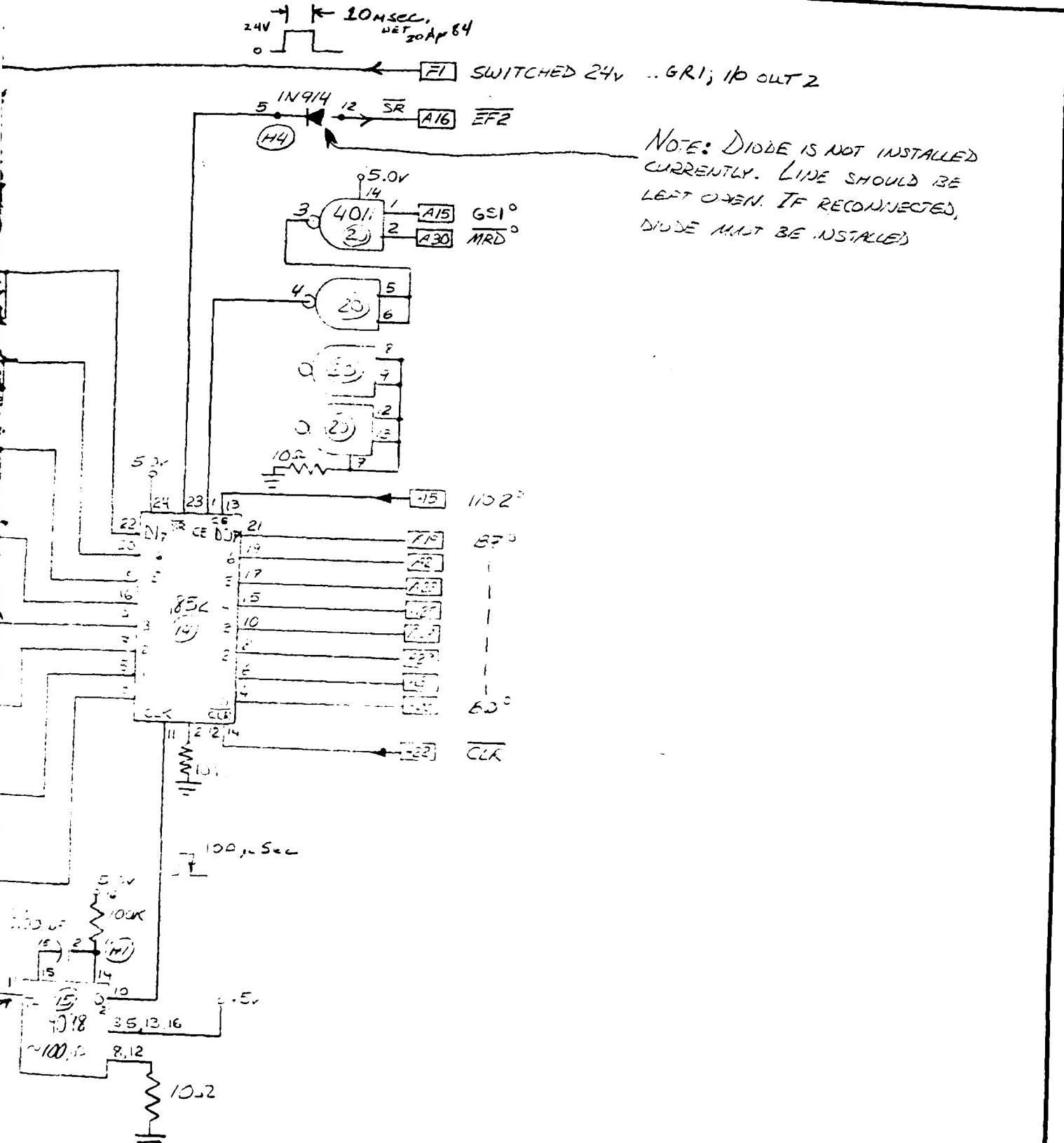


DIGITAL X-RAYS ESTIMATED IN 2 MIN WITH 3D AND CED DRIVE

1309 : 1

PROJ.

SHEE



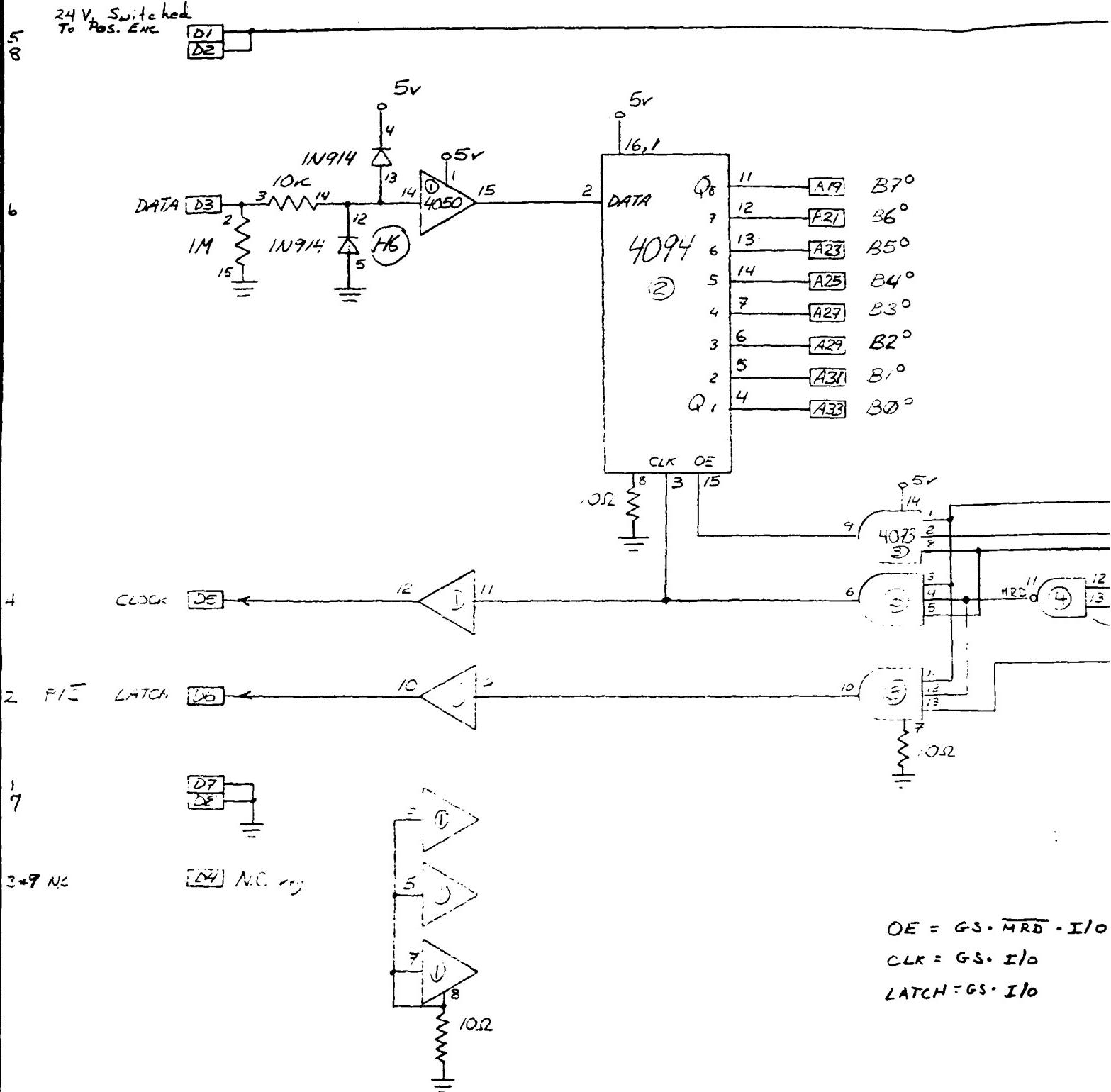
REV 15 Oct 84 WET
 NOTE: INTERCHANGE WIRING (2 instead of 3) WILL ALLOW USE OF 4070 XOR IN PLACE OF 4077 XNOR
 (on 4042 output)

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 Woods Hole, Mass. 02543
 Proj. 10182.69 BY ARD
 Sheet 2 of 4 Date 22 Feb 83

Title INTERFACE BOARD
 COMPASS-INTERFACE
 SEA DUCT
 SD-B019

9 pin GRN
Molex

24 V. Switched
To Pos. Enc.



$$OE = GS \cdot \overline{MRD} \cdot I/O$$

$$CLR = GS \cdot I/a$$

LATCH = GS • I10

F2 SWITCHED 24V — Relay Driver # φ1Q

CONN. 1 pin 7
(WHT/GRN)

A17 GS0°

A15 GS1°

A13 GS2°

A12 GS3°

A5 I/O2°

A3 I/O3°

A1 I/O4°

A6 I/O5°

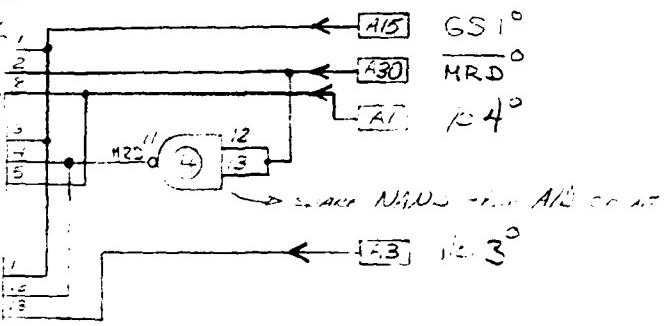
A4 I/O6°

A2 I/O7°

A16 EF2

A14 EF3

A11 EF4



0.2

$$E = GS \cdot MRD \cdot I/O = GS 1 \cdot INP 4$$

$$R = GS \cdot I/O = GS 1 \cdot OUT 4$$

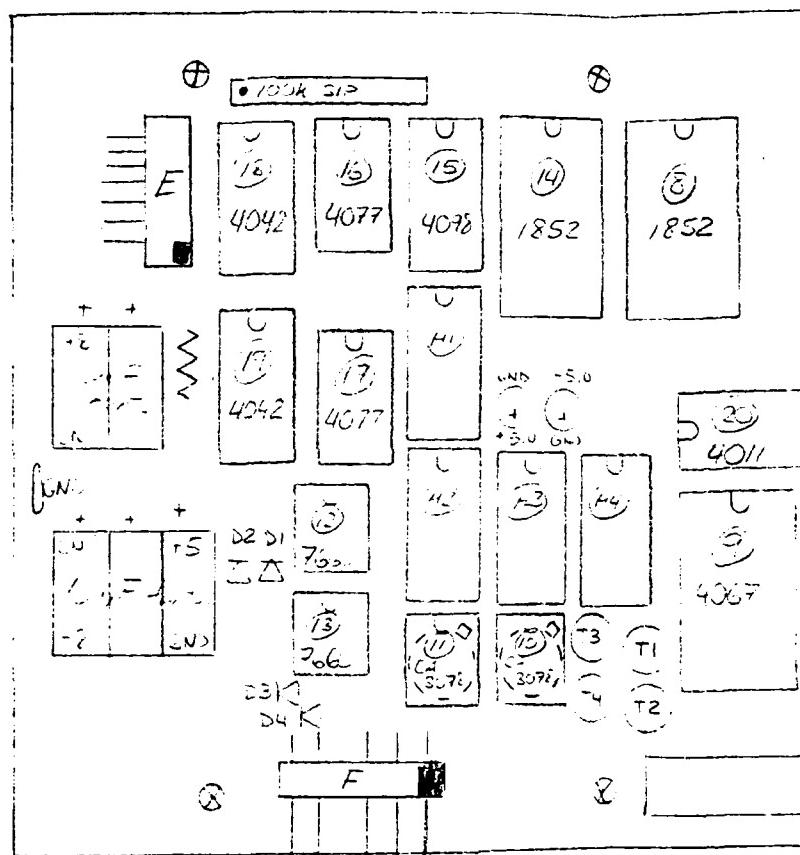
$$TCH = GS \cdot I/O = GS 1 \cdot OUT 3$$

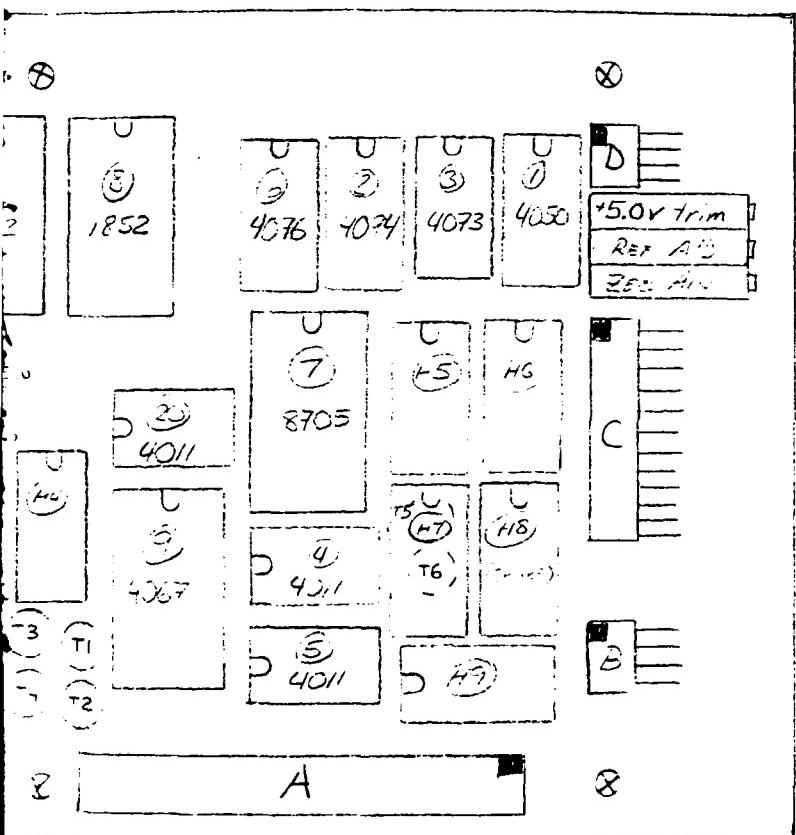
REV 24 Nov 86 WET
16 Oct 84 WET
REV 27 July 83 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10182.69 BY ARD
SHEET 3 OF 4 DATE 14 MAR 83

TITLE Interface Board
Rotation Encoder Interface

SEA DUCT
SD-B-020

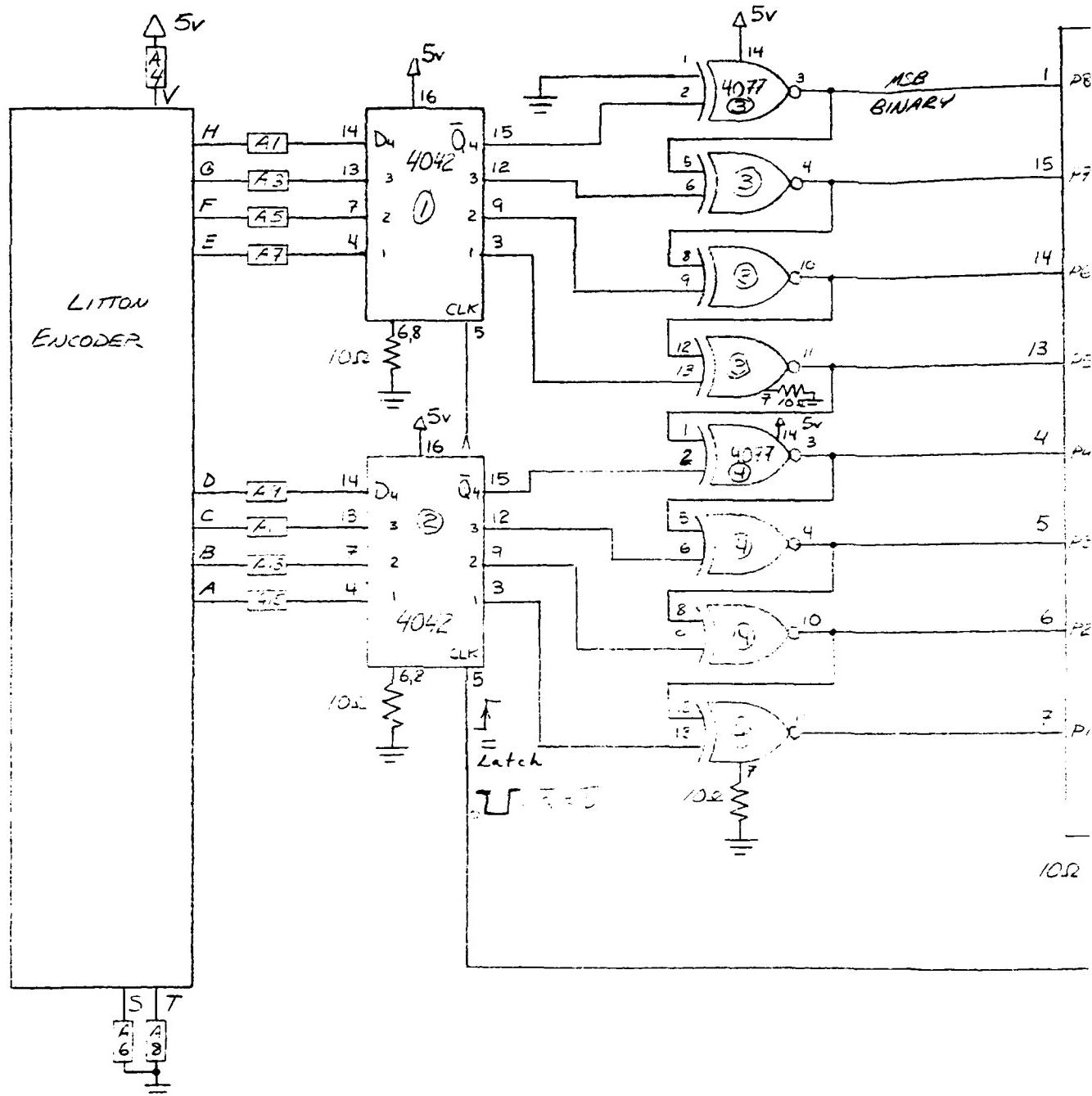


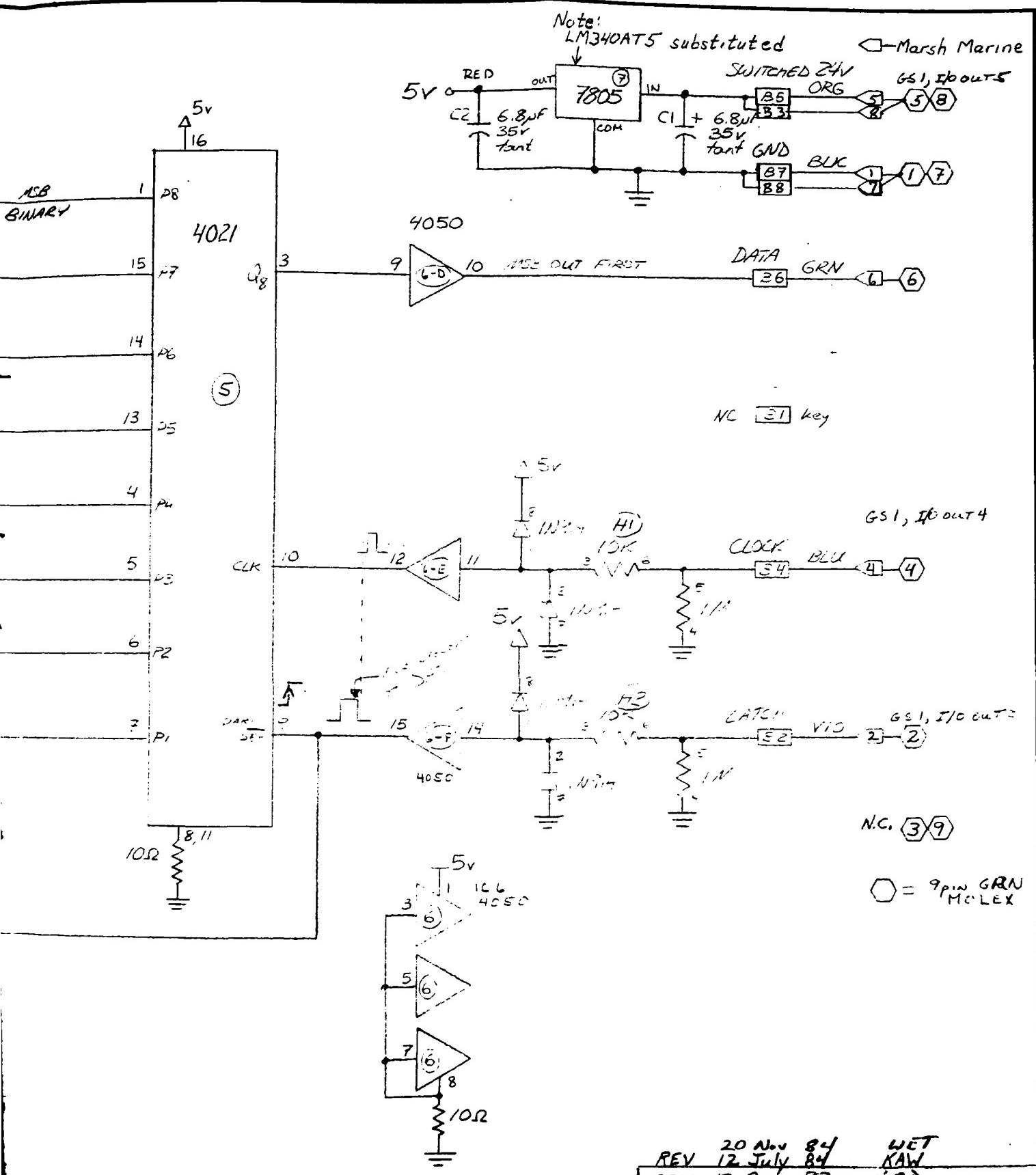


WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02548
PROJ. 10182.69 BY ARD
SHEET 4 OF 4 DATE 28 SEP 83

TITLE Interface Board
Parts Layout

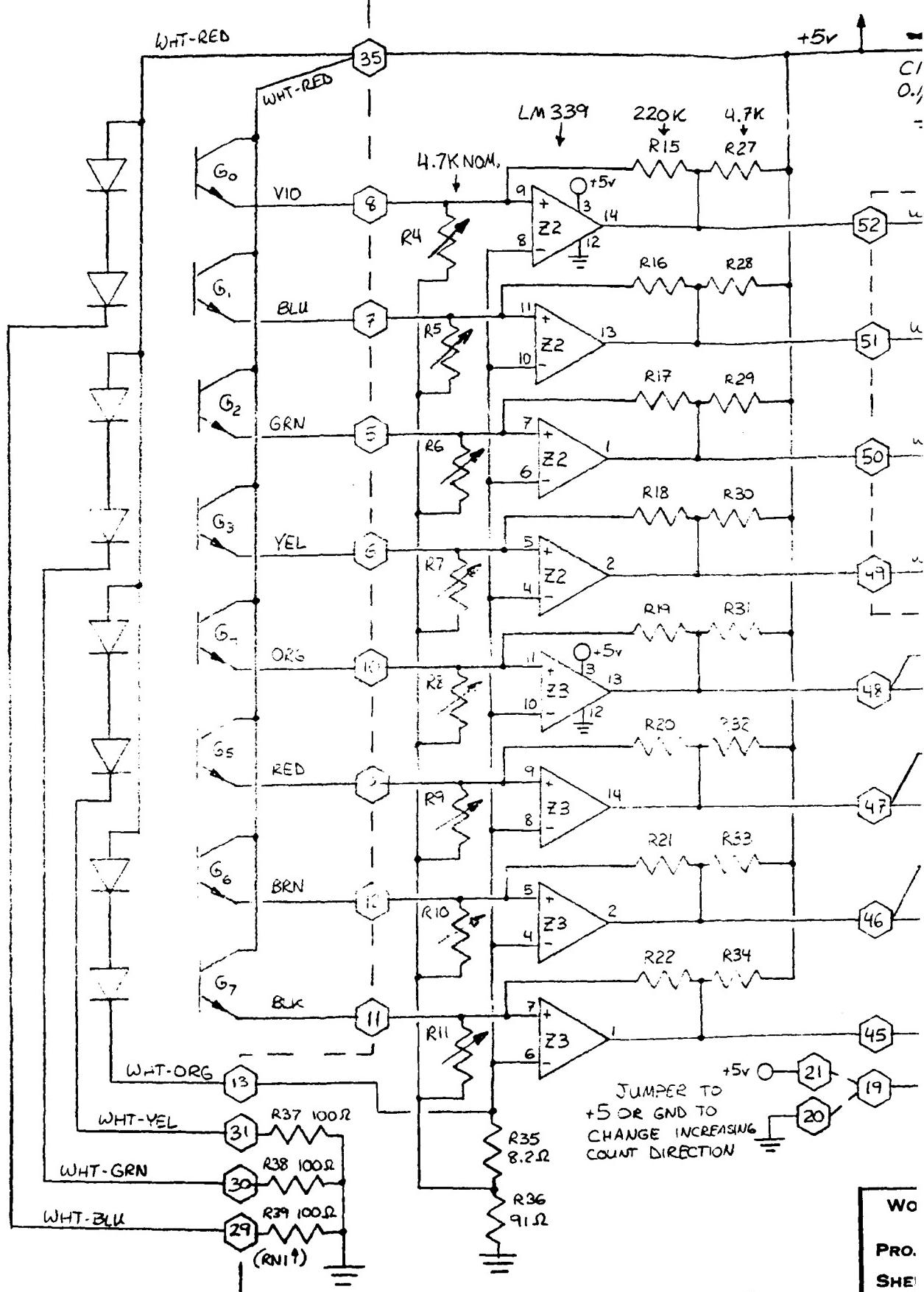
SEARCHED
SERIAL
SD-B-021





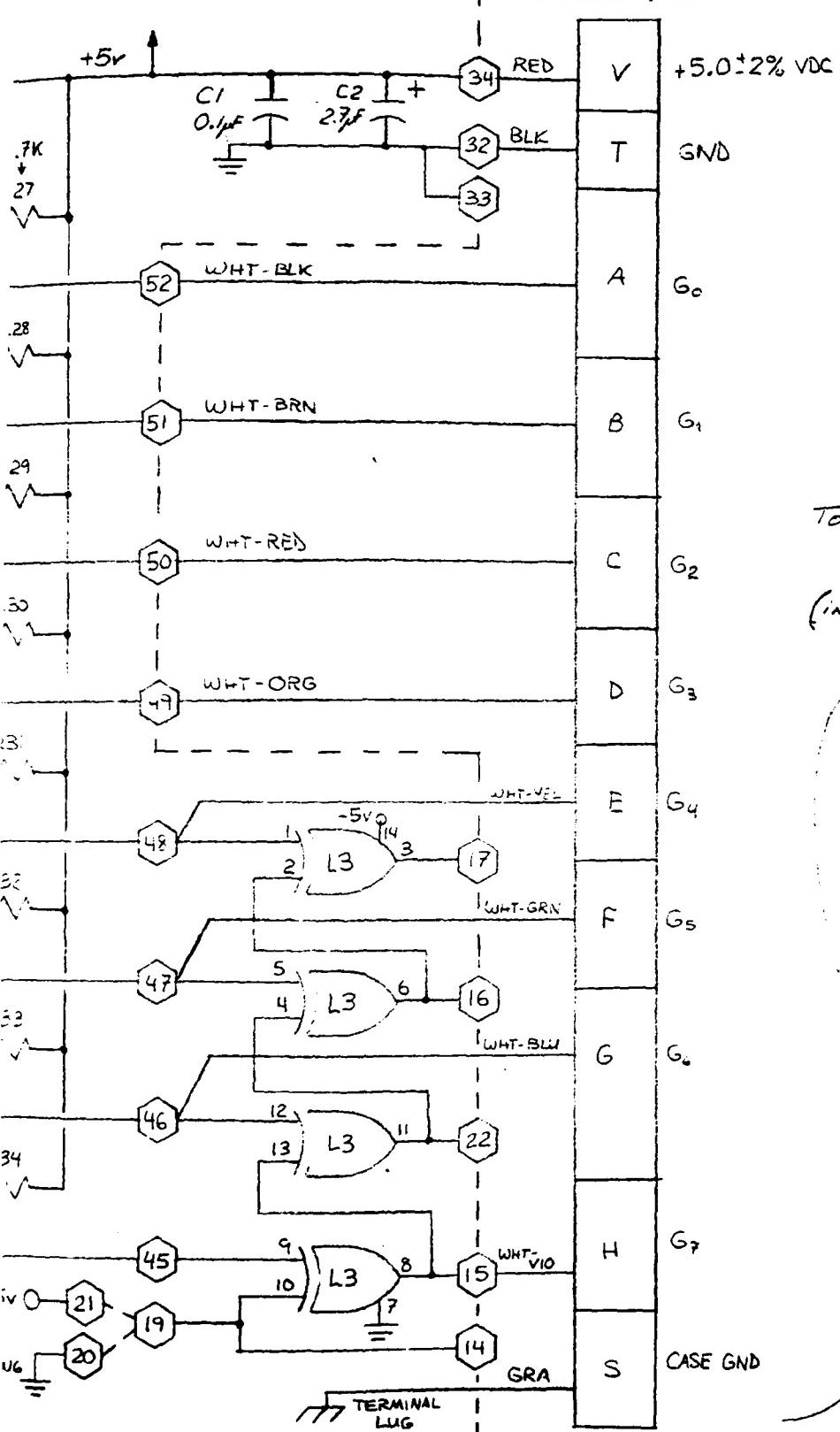
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/182 67 BY APD
SHEET 1 OF 3 DATE 14 MARCH 68

TITLE
**Rotation Encoder Interface
(Encoder Housing)**
SEA DUCT
SD-B-022



29215 -3 \$ -16

PT07C-14-19P



To:
POSITION ENCODER Interface
(in Encoder Press. Housing)

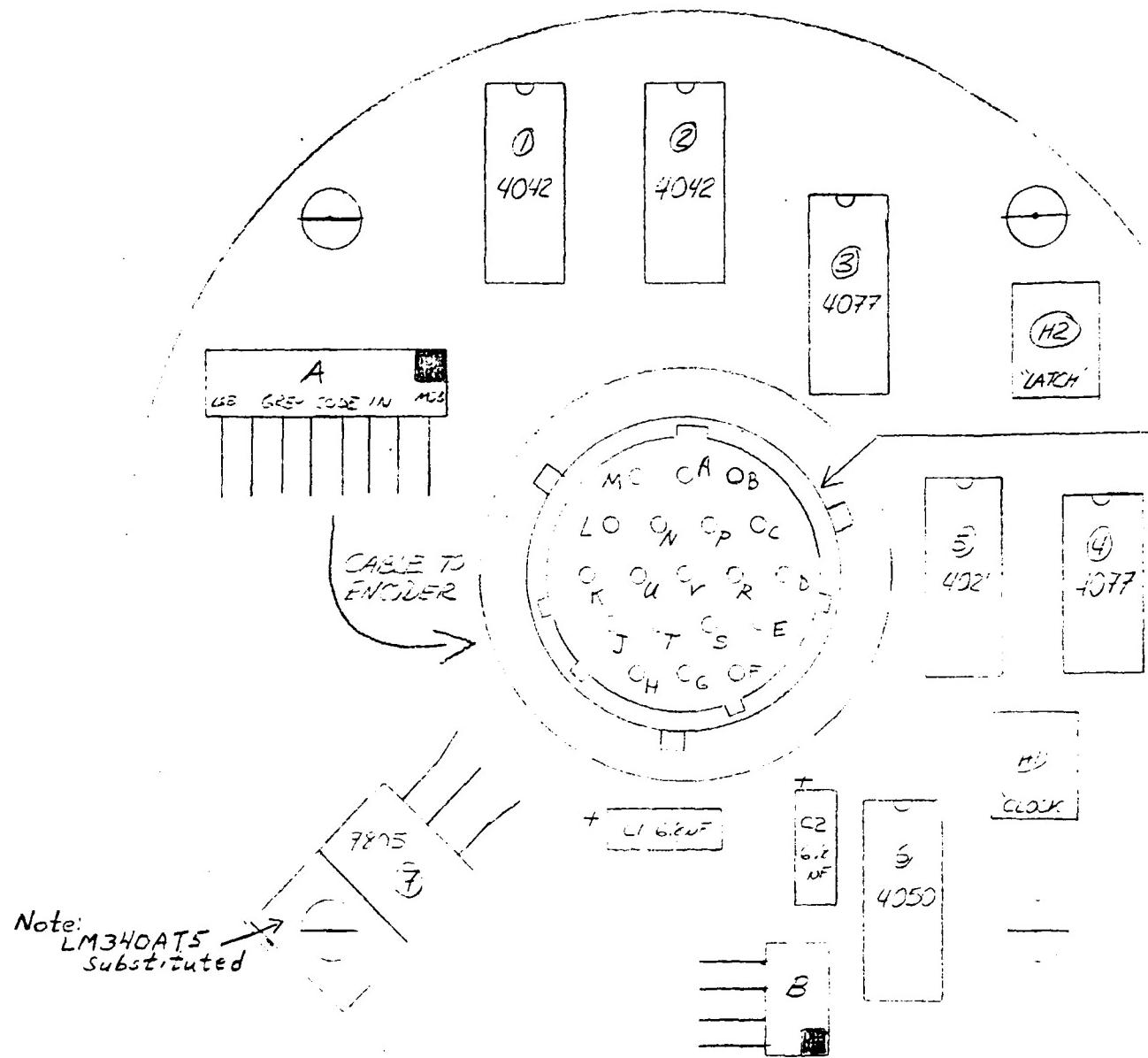
REV 20 Nov 84 W.E.T.

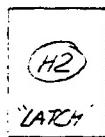
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82.69 BY ARD
SHEET 2 OF 3 DATE 15 FEB 83

TITLE

LITTON Rotation Encoder SEA DUCT

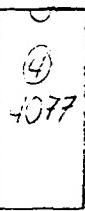
SD-B-023





ZARCH

CONNECTOR JN
ROTATION ENCODER



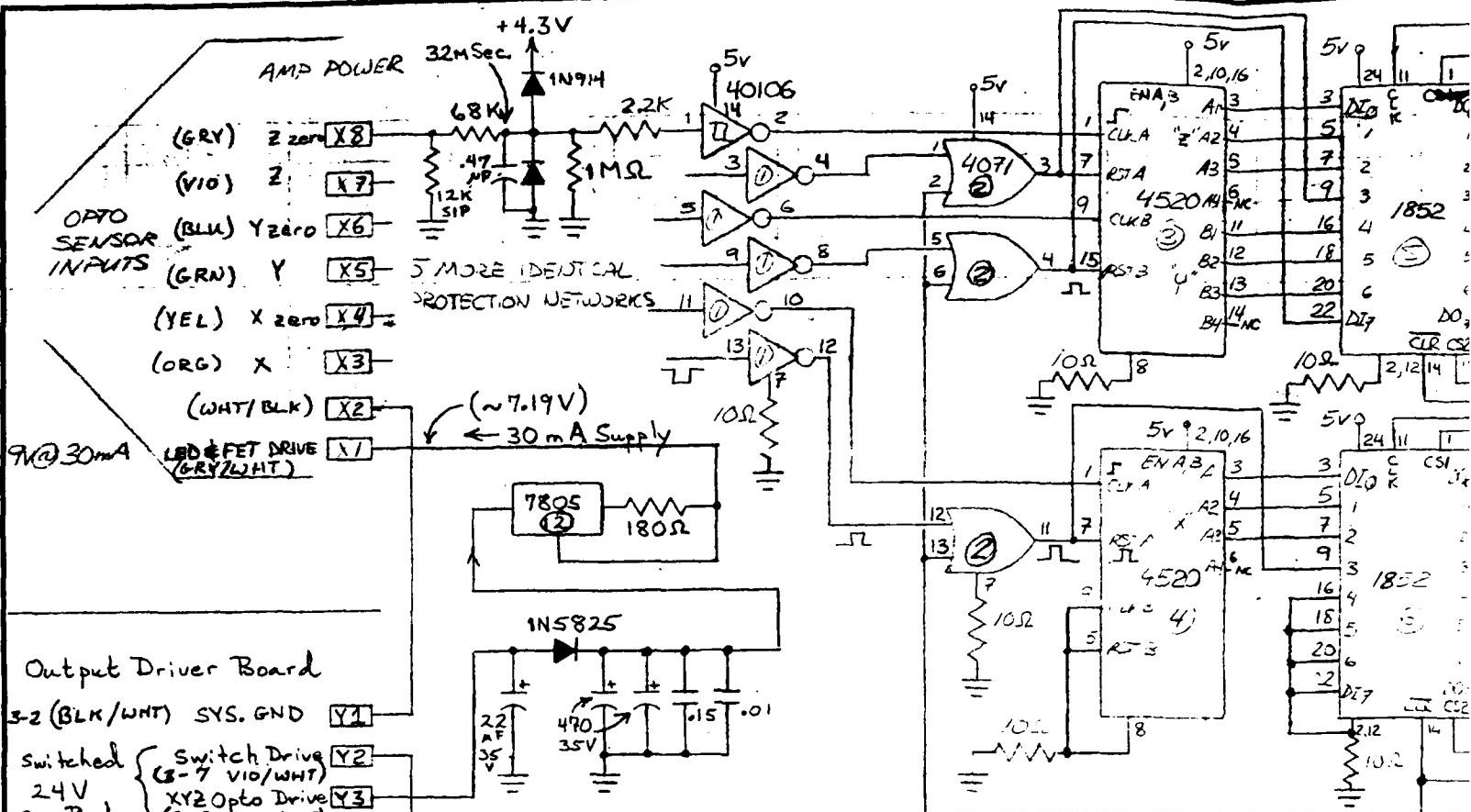
CLOCK

20 Nov 84 WET
REV 12 July 84 KAW

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10182.69 BY ARD
SHEET 3 OF 3 DATE 19 Oct 83

TITLE
Rotation Encoder Interface
Parts Layout
(Encoder Housing)

SEA DUCT
SD-13-024



Output Driver Board

3-2 (BLK/WHT) SYS. GND

Switched
24 V
Sys. Bat { Switch Drive
(3-7 VIO/WHT)
XYZ Opto Drive
(3-8 GRV/WHT)

50mA, Max

(WHT/VIO) Sw. Drive E10

(WHT) Ins 1 Z9

(GRY) Ins 2 Z8

(VIO) Ins 3 Z7

(BLU) Ins 4 Z6

(GRN) Ins 5 Z5

(ORG) SPARE Z3

(RED) Bottom Z2

Bottom switch INPUTS

12V

0.1

1N4148

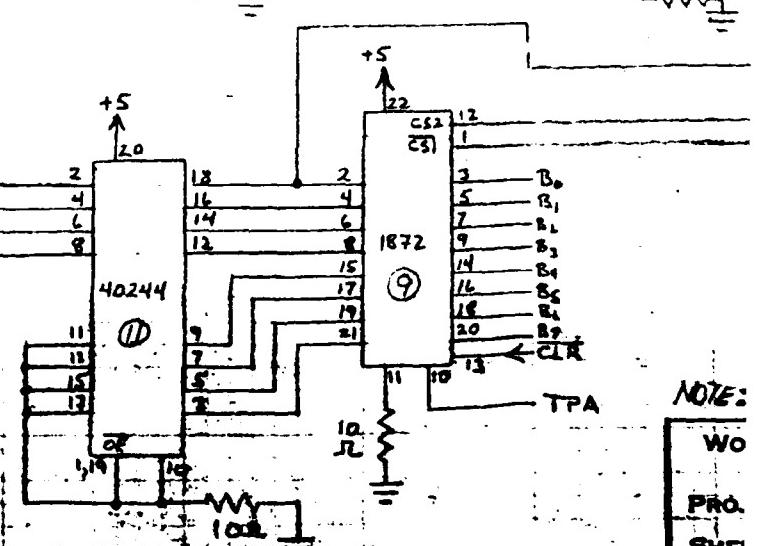
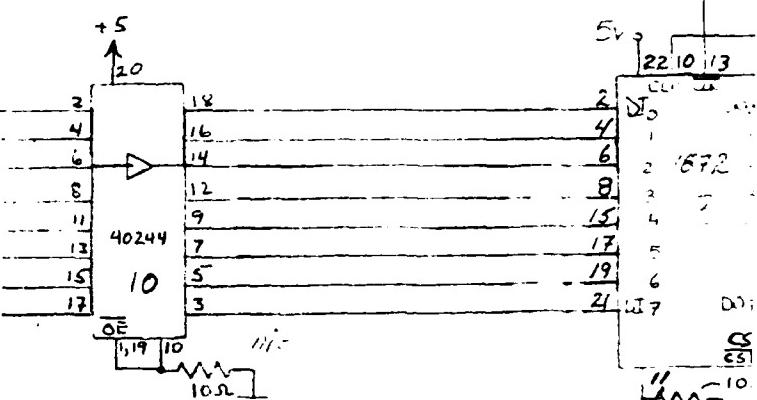
1N4007

WHT GRY VIO M

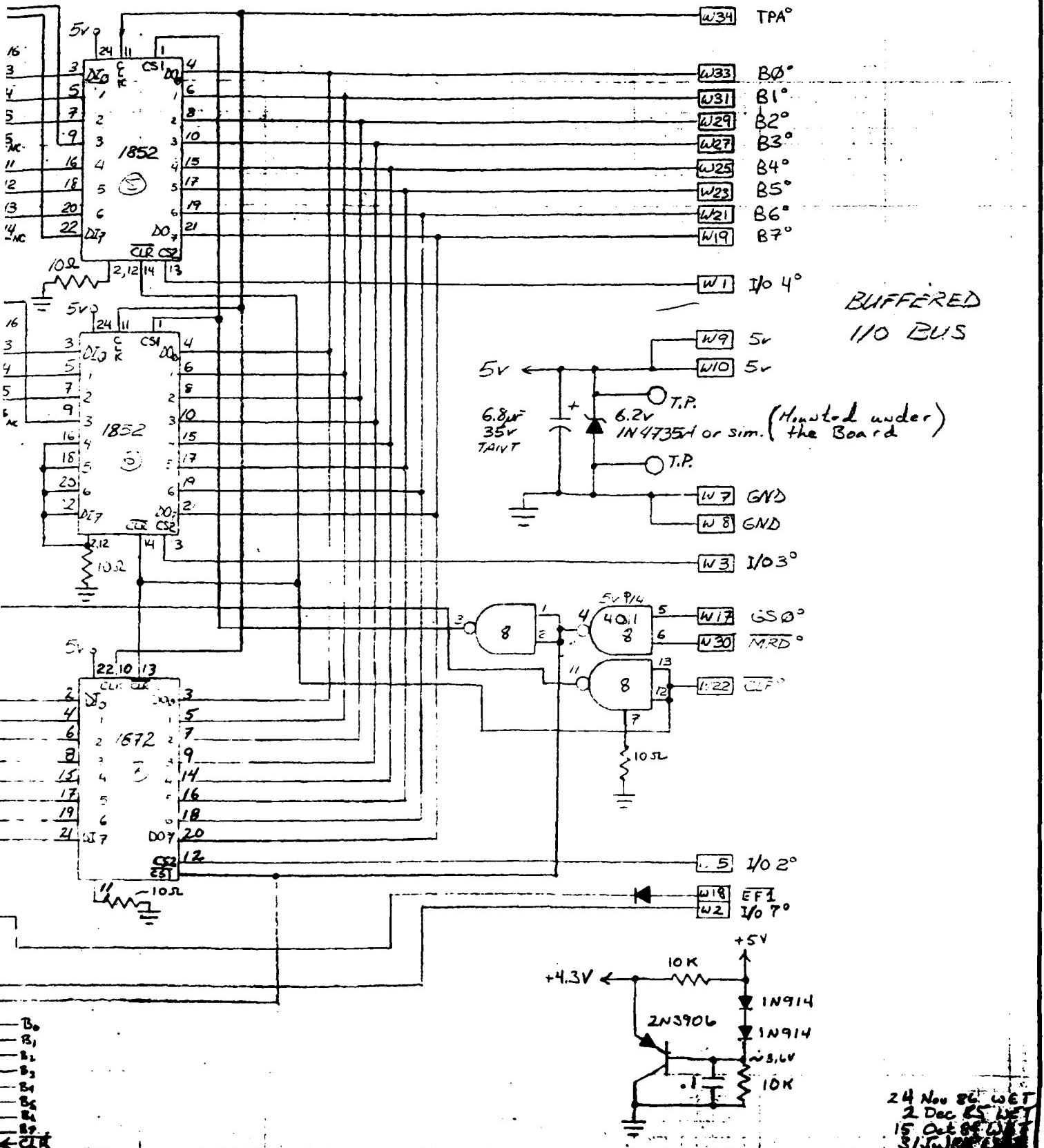
WHT

Acoustic Signal Inputs (BLU) (GRN) (YEL)

Sig A AA6 6.8k 2.2k
 Sig B AA5 1MΩ
 Sig C AA4
 NC AA3 3 MORE IDENTICAL PROTECTION NETWORKS
 NC AA2 NC KEY
 NC AA1



NOTE:



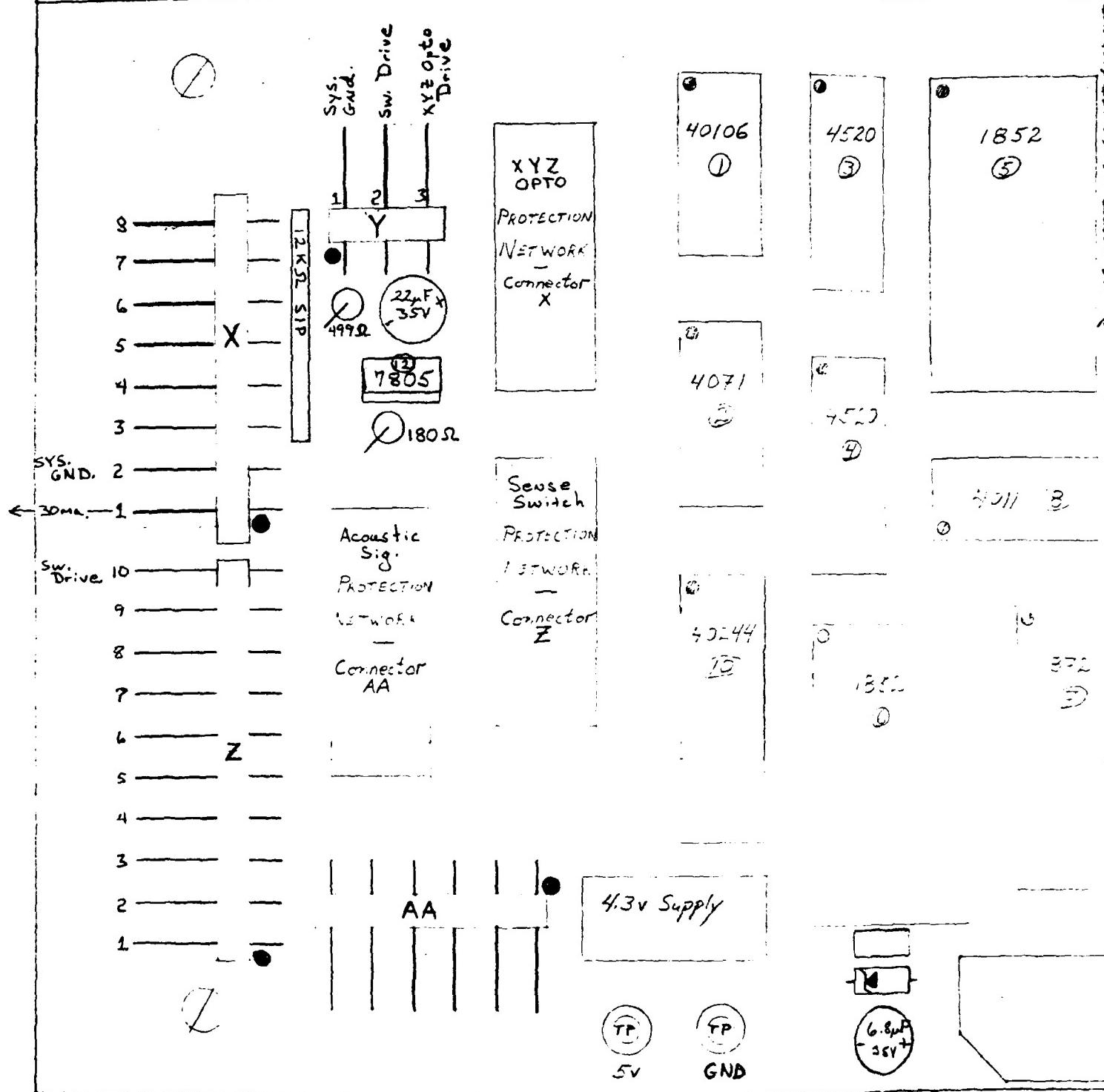
NOTE: COUNTERS INCREMENT ON LEADING EDGE OF OPTICAL INTERRUPTION.

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 1018667 BY ARD
SHEET 1 OF 2 DATE 27 Oct 63

TITLE

Auxiliary Board

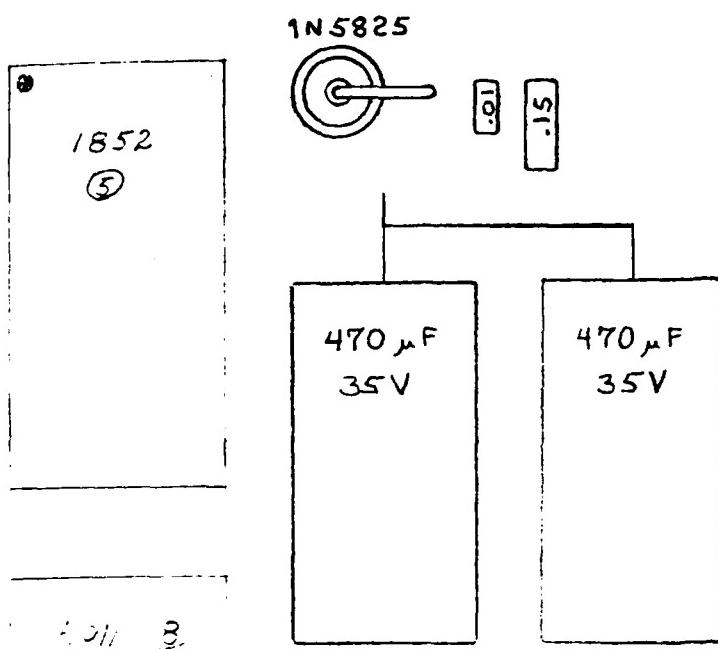
24 Nov 86 WET
2 Dec 85 WET
15 Oct 89 WET



WOOD

PROJ.

SHEET.



W 5 10 15
372 1852 20.00
③ ② ①

.01
.15

05 Dec 85 WET
20 Nov 84 WET
REV 12 July 84 KAW

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82.69 BY KAW
SHEET 2 OF 2 DATE 26 Jan 84

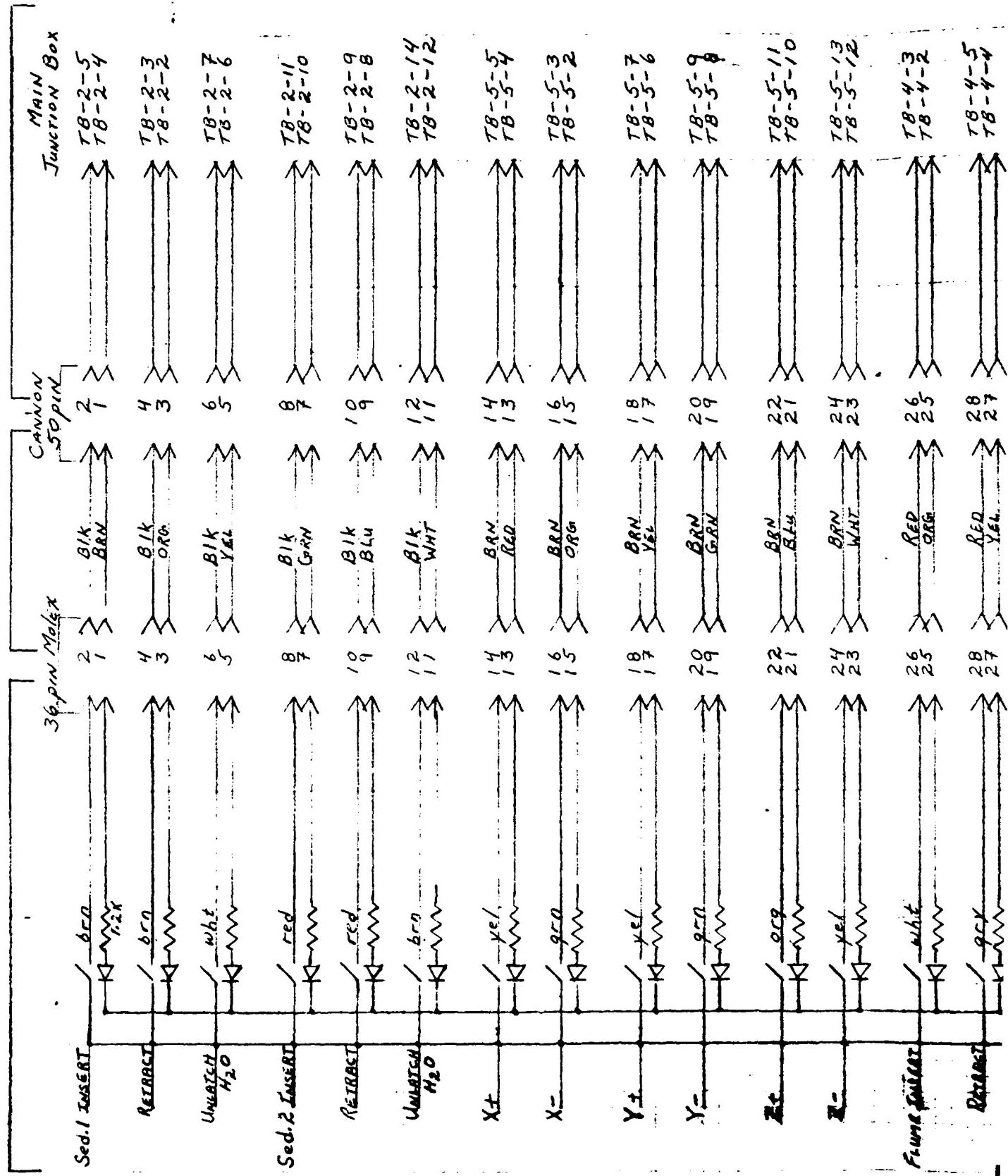
TITLE

Auxillary Board - Parts Layout
SEA DUCT

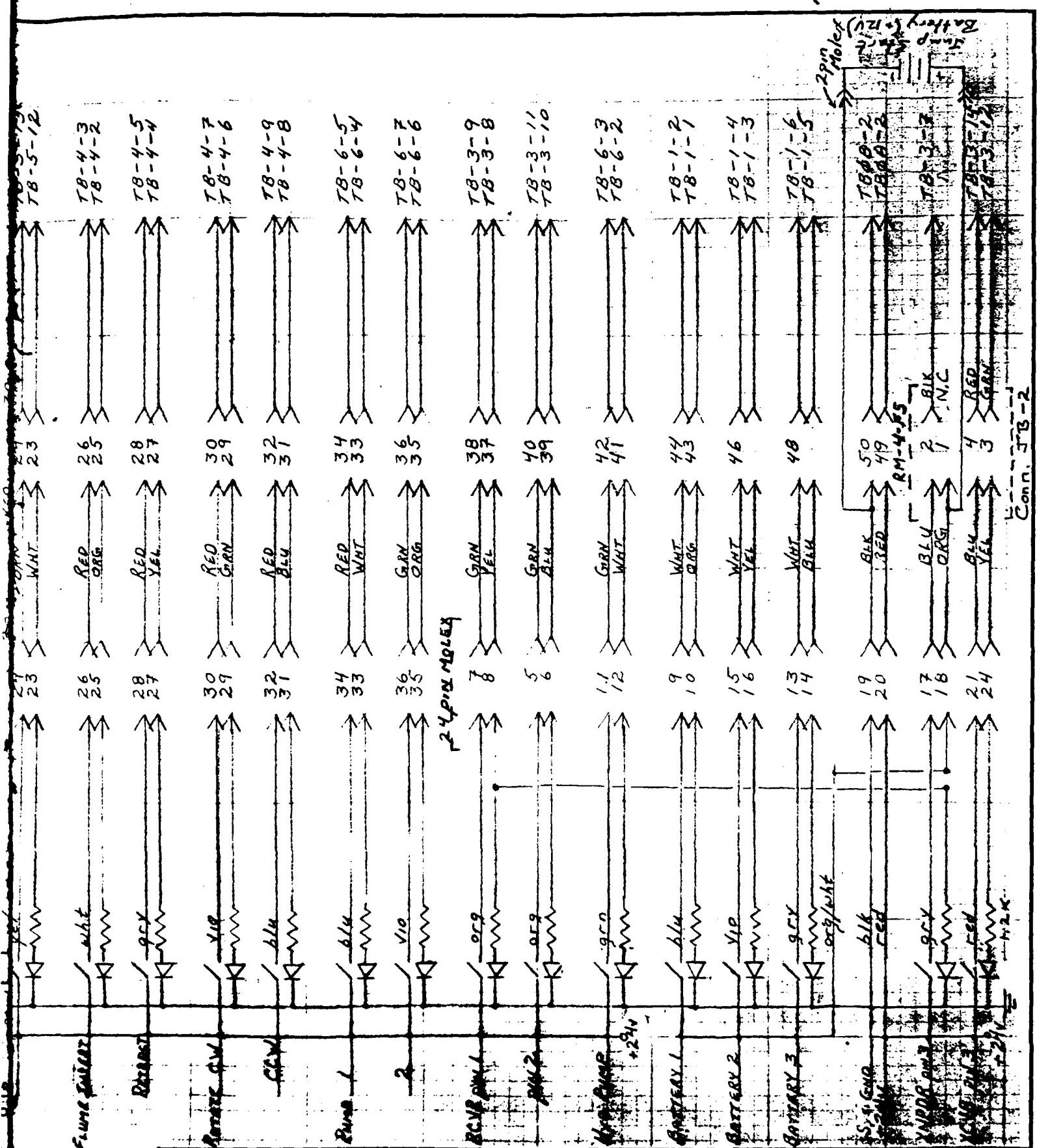
SD-R-1021206

Sea Duct Main Junction Box

Manual Control Box Control Cable



Rev 24 Nov 85 WST
Rev 24 July 86 KAW



WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543	TITLE <i>Water Control Box Survey</i>
PROJ. <i>10/09/69</i> BY <i>A. M. Johnson</i>	SD-8-0027
SHEET <i>1</i> OF <i>1</i> DATE <i>5/1969</i>	SEA DATES

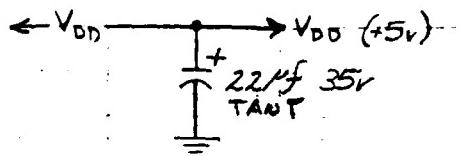
J4

50 pin Amp

To Connector
Buffer Board

1	I/O 4° TP 3
2	I/O 7° TPL
3	I/O 3° TP 2
4	I/O 6° TPS
5	I/O 2° -TP 1
6	I/O 5° TP 4
7	GND TP 0
8	GND TP 27
9	+V _{DD} TP 26
10	+V _{DD} TP 25
11	EF4 TP 24
12	N.C. (KEY)
13	MWR° -TP15
14	EF3 TP 23
15	A7'
16	EF2 TP 22
17	A6'
18	EF1 TP 21
19	A5'
20	A2 TP 13
21	A4'
22	N1 TP 12
23	A3'
24	NΦ TP 11
25	A2'
26	GS Z° TP 9
27	A1'
28	GS 1° TP 8
29	AΦ
30	GS Φ° TP 7
31	B7°
32	WAIT TP 19
33	B6°
34	CLR TP 20
35	B5°
36	SCI

37	84°
38	SCΦ
39	B3°
40	Q° TP 18
41	82°
42	MRD TP 14
43	B1°
44	INT TP 25
45	BΦ°
46	GS3° TP 10
47	TPB° ZP 29
48	DMA OUT -TP16
49	TPA° TP 28
50	DMA IN -TP17



← AΦ'
← A1'
← A2'
← A3'

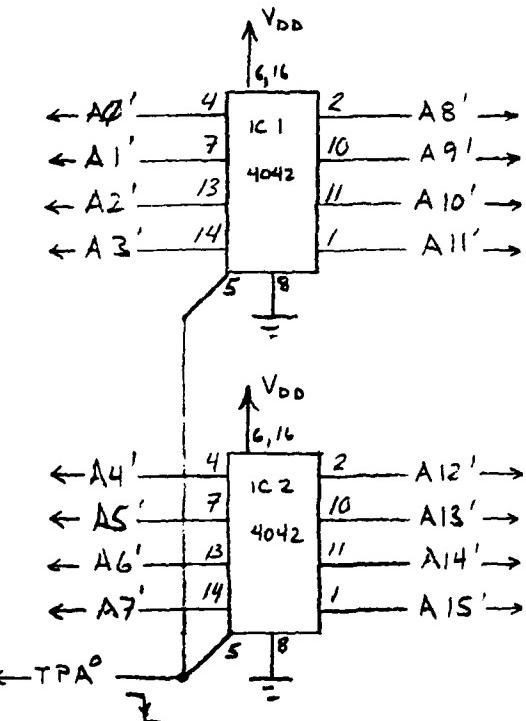
← A4'
← A5'
← A6'
← A7'

← TPA° -

7Ω CONNECT
POW SER DUCT
SPLITTER BOARD

V_{DD} (+5v)

2μf 35v
ANT



J2
26 PIN AMP
POD 3

A9'	J2-1	-0
A10'	J2-2	-1
A11'	J2-3	-2
A12'	J2-4	-3
A13'	J2-5	-4
A14'	J2-6	-5
A15'	J2-7	-6
N.C.	J2-8	-7
	J2-9	8
±	J2-10	GND
J3-8	J2-11	K CLK

J1
26 PIN AMP
POD 1

B0 ^o	-J1-1	-0
B1 ^o	-J1-2	-1
B2 ^o	-J1-3	-2
B3 ^o	-J1-4	-3
B4 ^o	-J1-5	-4
B5 ^o	-J1-6	-5
B6 ^o	-J1-7	-6
B7 ^o	-J1-8	-7
±	-J1-10	GND
J1-9 = KEY		

POD 2

A0'	-J1-13	-0
A1'	-J1-14	-1
A2'	-J1-15	-2
A3'	-J1-16	-3
A4'	-J1-17	-4
A5'	-J1-18	-5
A6'	-J1-19	-6
A7'	-J1-20	-7
AB'	-J1-21	-8
±	-J1-22	GND
J3-9	J1-23	-L CLK
J1-24 Key		

J2-12 = KEY

POD 4		
MWR	J2-13	0 ✓
MRD	J2-14	1 ✓
SCφ	J2-15	2 ✓
SCI	J2-16	3
J3-2	J2-17	-4
J3-3	J2-18	-5
J3-4	J2-19	-6
J3-5	J2-20	-7
J3-6	J2-21	8
±	J2-22	GND
TPB	J2-23	J CLK
J2-24 KEY		

J3 - 9 PIN 'D'

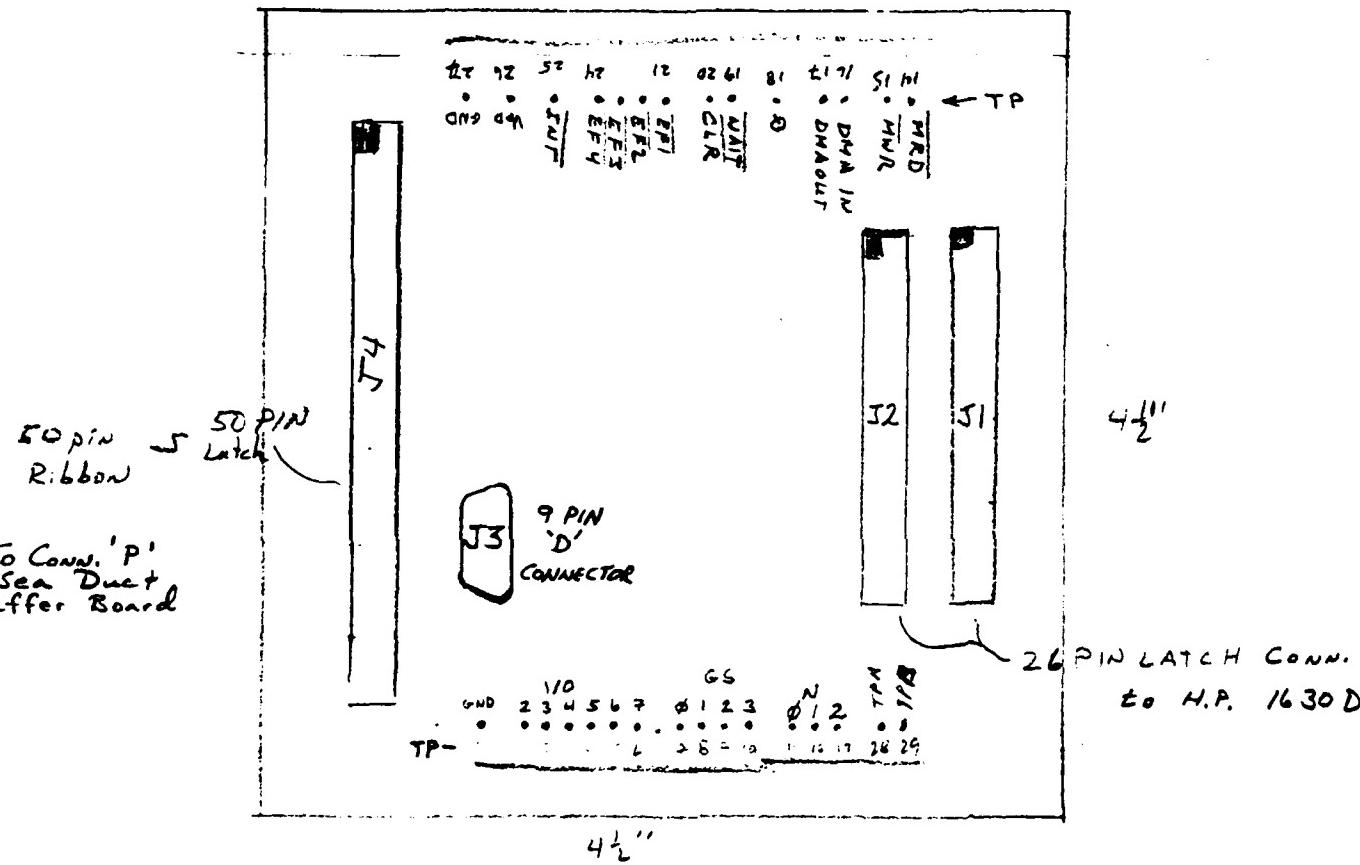
1	GND	BIK
2	POD4-4	BRN
3	POD4-5	RED
4	POD4-6	ORG
5	POD4-7	YEL
6	POD4-8	GRN
7	B2	
8	KC1K	
9	LC1K	

REV 2 Feb 84 465
REV 31 Oct 83 465

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10/82.69 BY WET
SHEET 1 OF 2 DATE 18 OCT 83

TITLE SEA DUCT - HP 1630 D Analyzer
Interface Box
SEA DUCT

SD-B-028.



J3

- 1 BLK Bongo w/GRY
- 2 BRN Bongo w/GRY WIRE
- 3 RED " "
- 4 ORG " "
- 5 YEL " "
- 6 GRN " "
- 7 BLU " "
- 8 NC
- 9 NC

CONN.
1630 D

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10182.69 BY WET
SHEET 2 OF 2 DATE 18 Oct 83

TITLE
SEA DUCT - HP 1630 D Logic Analyser
Interface Box - Legend
SEA Duct

SD-R-0029

JA-Pin:

1 — B₀
 2 — B₁
 3 — B₂
 4 — B₃
 5 — B₄
 6 — B₅
 7 — B₆
 8 — B₇
 9 — NC (KEY)
 10 — GND
 11 — NC
 12 — NC
 13 — B₈
 14 — B₉
 15 — A₂
 16 — B₁₀
 17 — B₁₁
 18 — A₃
 19 — NC
 20 — NC
 21 — A₄
 22 — GND
 23 — NC (KEY)
 24 — NC (KEY)
 25 — NC
 26 — NC

To S2 on
 Duct - HP, 1630D
 ERIC LUMMEER
 INTERFACE

JB-Pin:

1 — A₉
 2 — A₁₀
 3 — A₁₁
 4 — A₁₂
 5 — A₁₃
 6 — A₁₄
 7 — A₁₅
 8 — NC
 9 — NC
 10 — GND
 11 — NC
 12 — NC (KEY)
 13 — ~~RAZ~~
 14 — RRD
 15 — SCC
 16 — SEL
 17 — ERIC LUMMEER (NC)
 18 — ERIC LUMMEER
 19 — ERIC LUMMEER
 20 — ERIC LUMMEER
 21 — ERIC LUMMEER
 22 — ERIC LUMMEER
 23 — ERIC LUMMEER
 24 — NC (KEY)
 25 — NC
 26 — NC

To S2 on
 Duct - HP, 1630D
 ERIC LUMMEER
 INTERFACE

WOODS HO

CONTRACT NO. /

BY WET

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

J2-PIN:

Z ₀	1
Z ₁	3
Z ₂	5
Z ₃	7
Z ₄	9
Z ₅	11
Z ₆	13
Z ₇	15

Pak

J3-PIN:

A ₀	1
A ₁	3
A ₂	5
A ₃	7
A ₄	9
A ₅	11
A ₆	13
A ₇	15

Pod

A₀ — 2
A₁ — 4
A₂ — 6
A₃ — 8
A₄ — 10
A₅ — 12
A₆ — 14
A₇ — 16

Pak

SC4 — 1
SC2 — 2

R₁₀₂ — 3
R₁₀₃ — 4
R₁₀₄ — 5
R₁₀₅ — 6
R₁₀₆ — 7
R₁₀₇ — 8
R₁₀₈ — 9
R₁₀₉ — 10
R₁₁₀ — 11
R₁₁₁ — 12
R₁₁₂ — 13
R₁₁₃ — 14
R₁₁₄ — 15
R₁₁₅ — 16

Pod

GND — 10
V_{DD} — 15

GND — 10
V_{DD} — 15

Note:

HP 1610 Clock Pak GND = GND
KCLK = TPE

To:
HP 1610 Logic Pak Pak

WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

TITLE
HP 1610 / 4010 Analyzer
Interface Box CEA Duct

CONTRACT NO. 1018269

CODE NO.

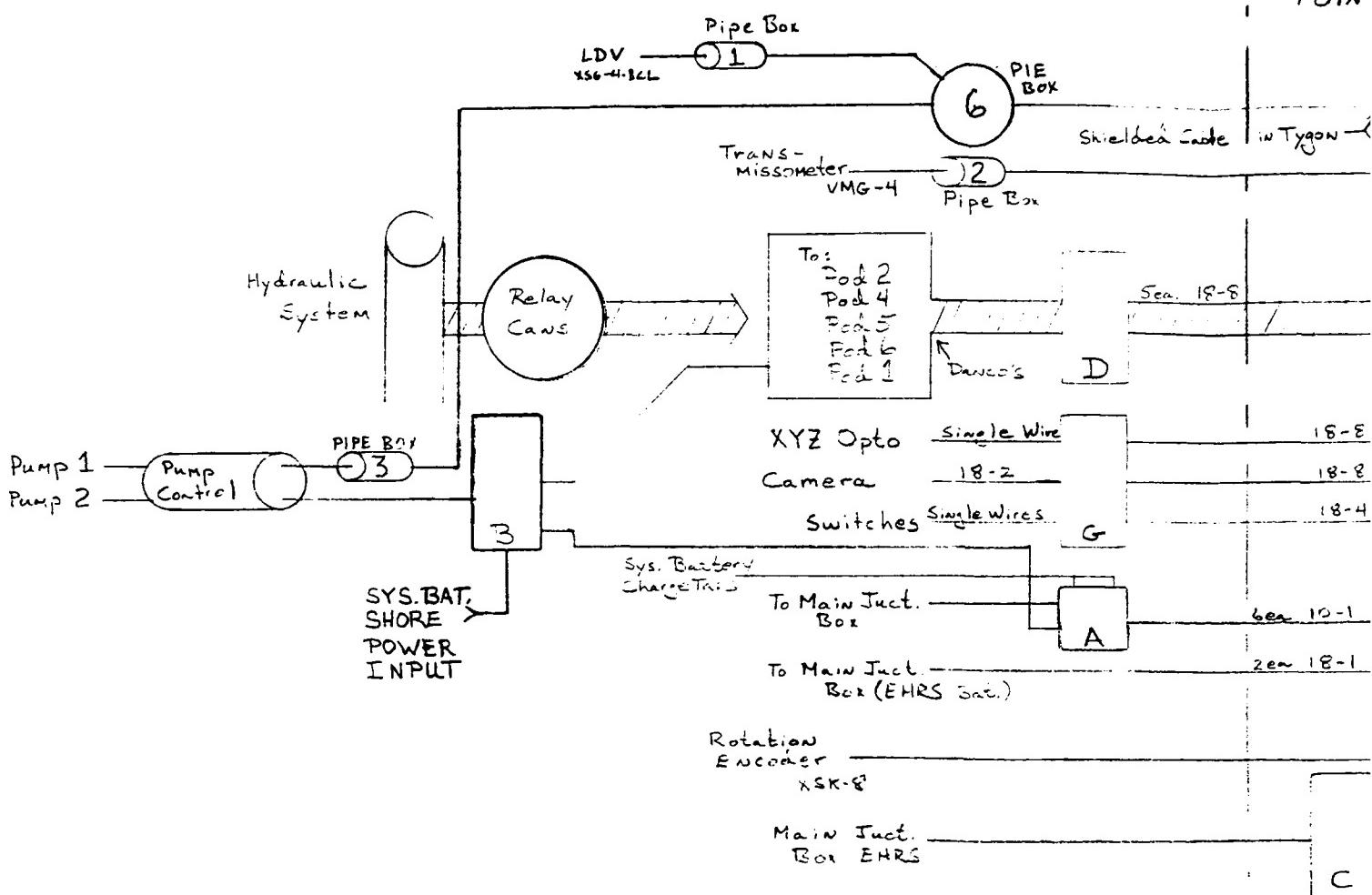
BY WET

DATE 12 July 87 SIZE B

DWG. NO. SD-B-030

OF

REV.



EHRS = Emergency Hydrostatic Release System

Rotation Side

FOTOBEST/BROOKSIDE 0232-B

4

3

woo

CONTRACT
BY W. C.

2

1

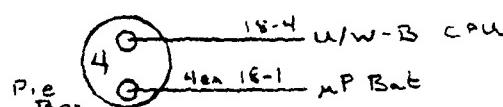
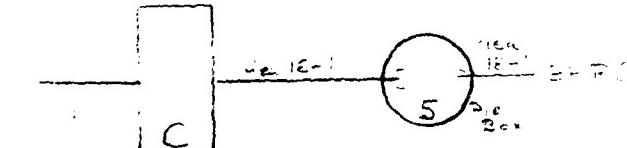
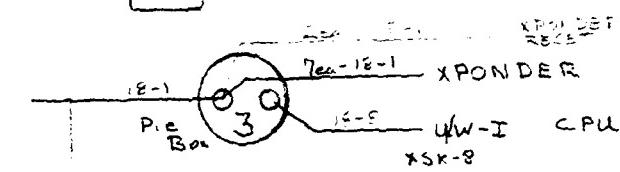
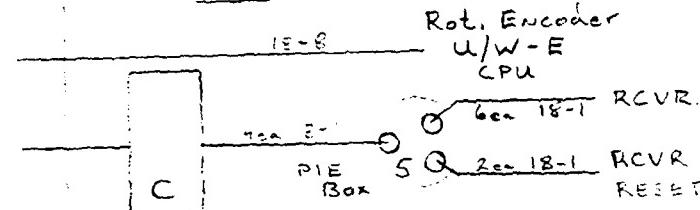
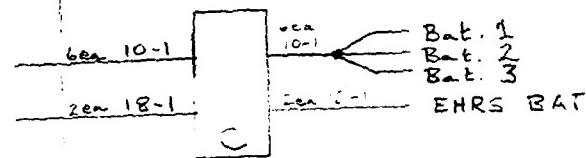
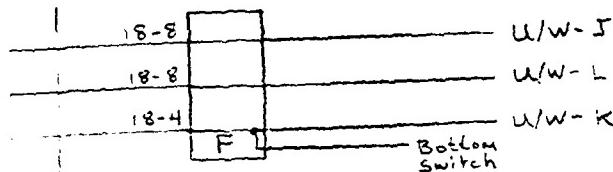
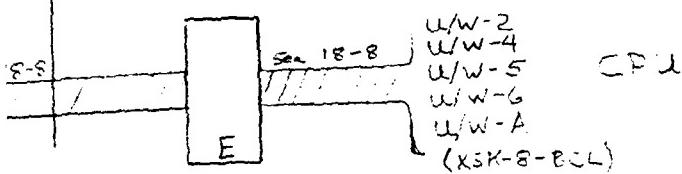
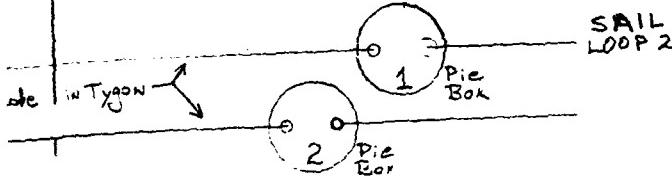
REVISIONS

DESCRIPTION

DATE

APPROVED

Rotation Point



Leg Side

28 Mar 87 WET
12 Jun 86 WET
Rev. 23 Apr 86 WET

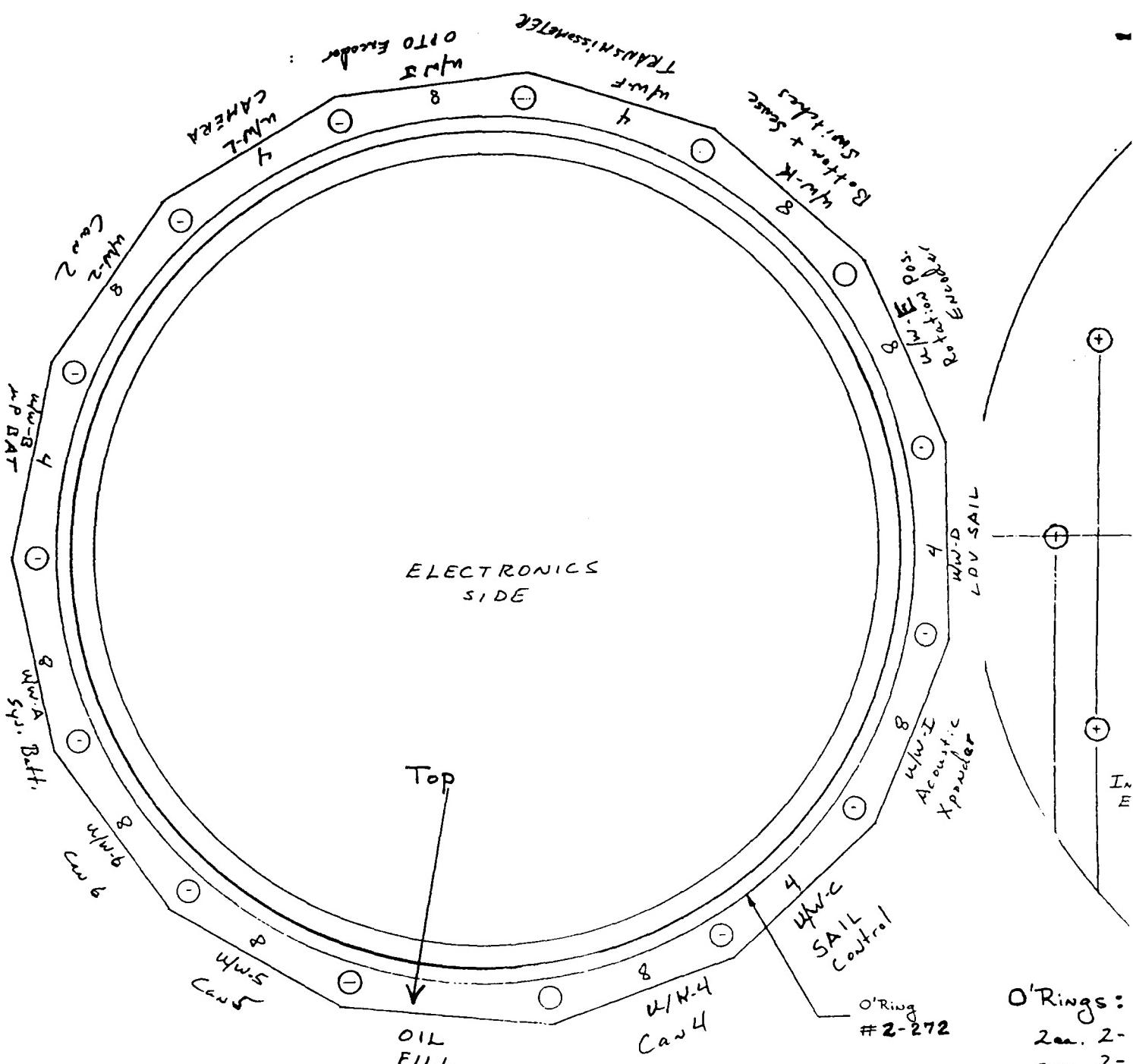
WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE Main Wiring Harness	
CONTRACT NO. 10 / 85.69		CODE NO.	
BY W. E. Terry		DATE 3 Dec 85 SIZE B	
		DWG. NO. SD-B Ø31	OF REV.

2

1

4

3

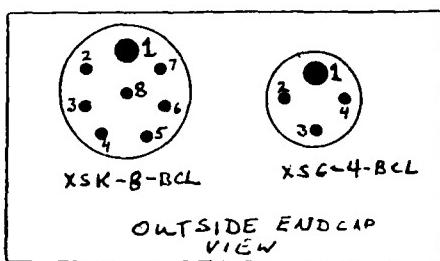


O'Rings:

2m. 2-

Lea 2 -

2ea 2-



O'Rings:
XSG-4-BCL = 9 ea.
2-213
~~XSK~~-8-BCL = 5 ea
2-217

SEA DUCT ENDCAP CONNECTORS

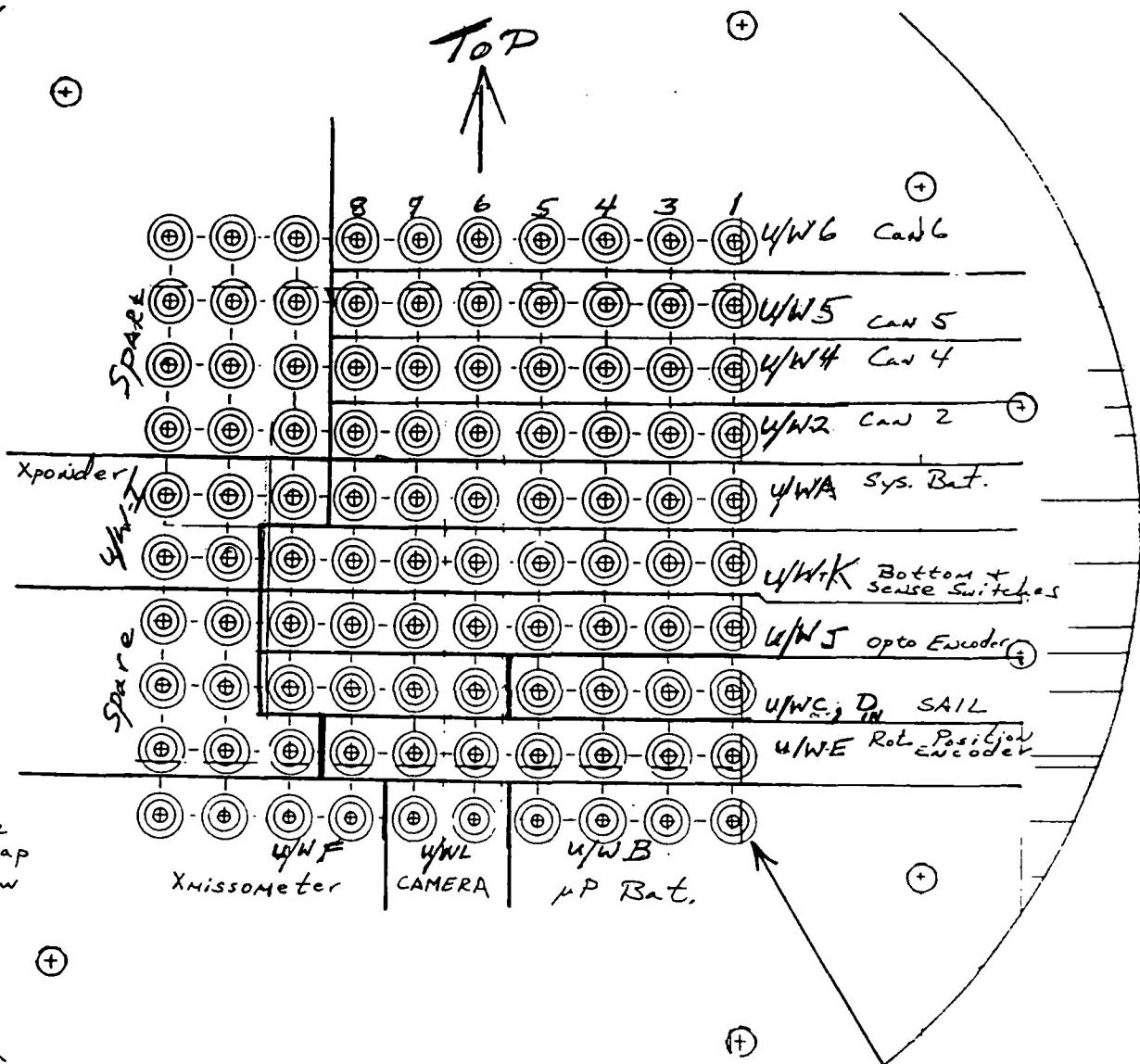
WO

4

3

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



O'Rings:

2ea. 2-273 } Endcap to
2ea. 2-276 } Pressure Housing
1ea 2-272 - Endcap to Oil-filled
Connector Housing
2ea 2-112 - Endcap purge plugs

100 ea.
Sinclair Mfg. Co.
TBTH SW 605SS
Glass to metal feed-thru.

WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

TITLE CPU Endcap -
Electrical Connections

CONTRACT NO. 10 / 85.69

CODE NO.

Sea Duct

BY W. Terry

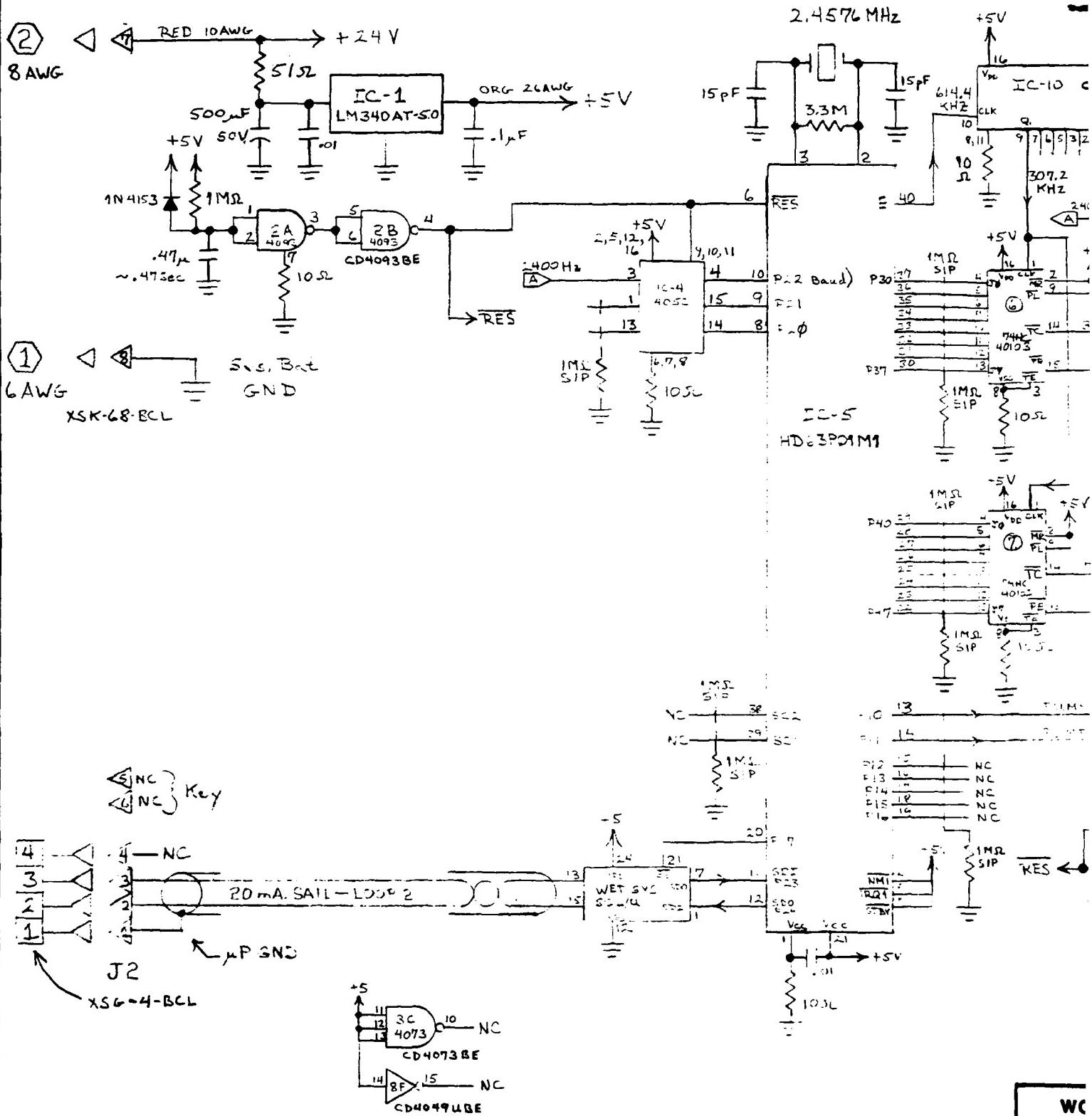
DATE 13 Dec 85

SIZE 8

DWG. NO. SD-B-032

OF

REV.

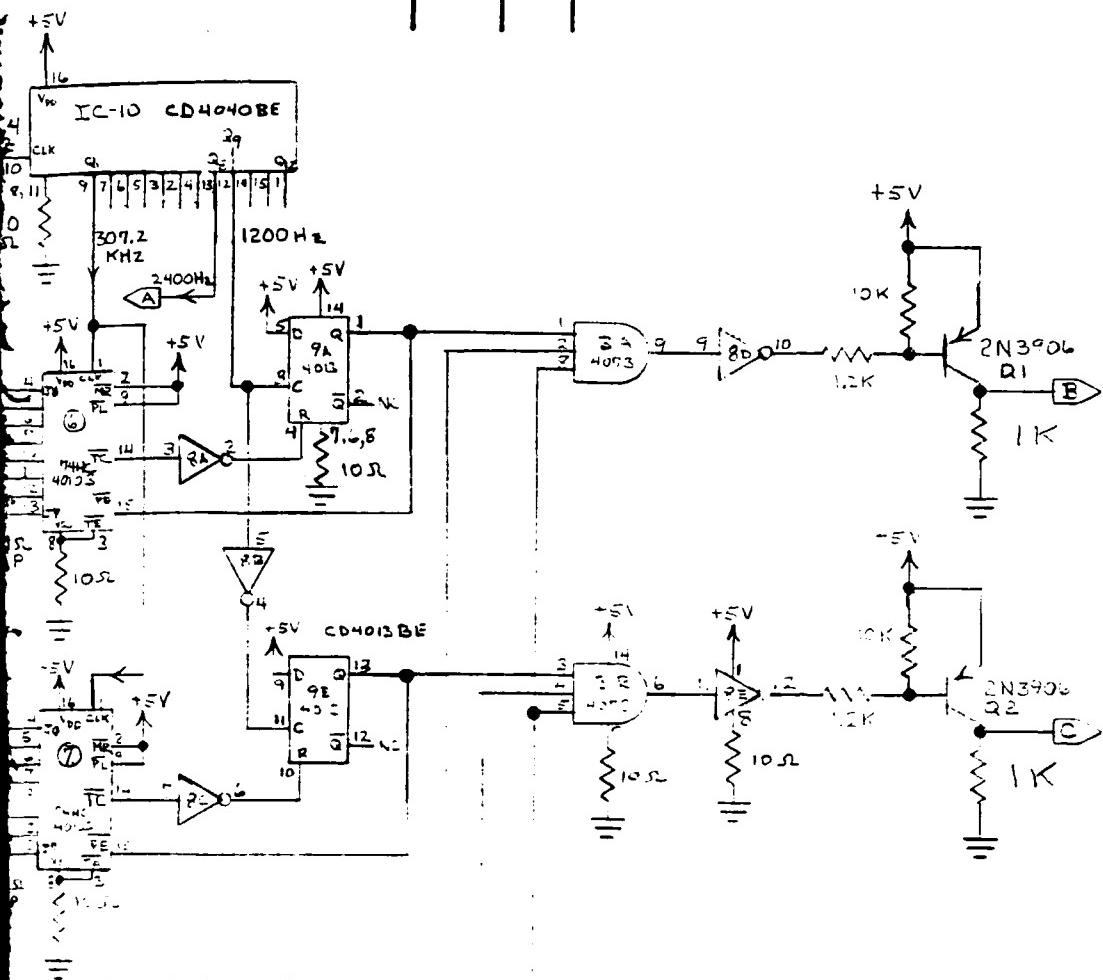


Continued on DWG SD-BØ34

Layout on DWG SD-BØ35

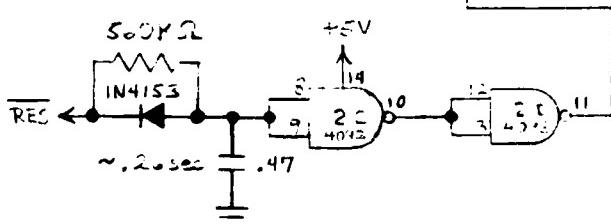
REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



TIME ENABLE

TIME DISABLE



CA 1
1 IN4153
2 1M
3 1.47uF
4 IN4153
5 560K
6 0.001uF
7 0.001uF
8 0.001uF
9 2N3906
10 1.0K

CA 2
1 15PF
2 XT61
3 15PF
4 3.3M
5 0.001uF
6 0.001uF
7 0.001uF
8 0.001uF

CA 3
1 1.2K
2 10K
3 2N3906
4 1.0K
5 1.2K
6 10K
7 0.001uF
8 0.001uF
9 2N3906
10 1.0K

CA 4
1 512
2 0.01uF
3 0.001uF
4 0.001uF
5 0.001uF
6 0.001uF
7 0.001uF

REV 26 Nov. 86 W.E.T.
REV. 23 Apr. 86 W.E.T.

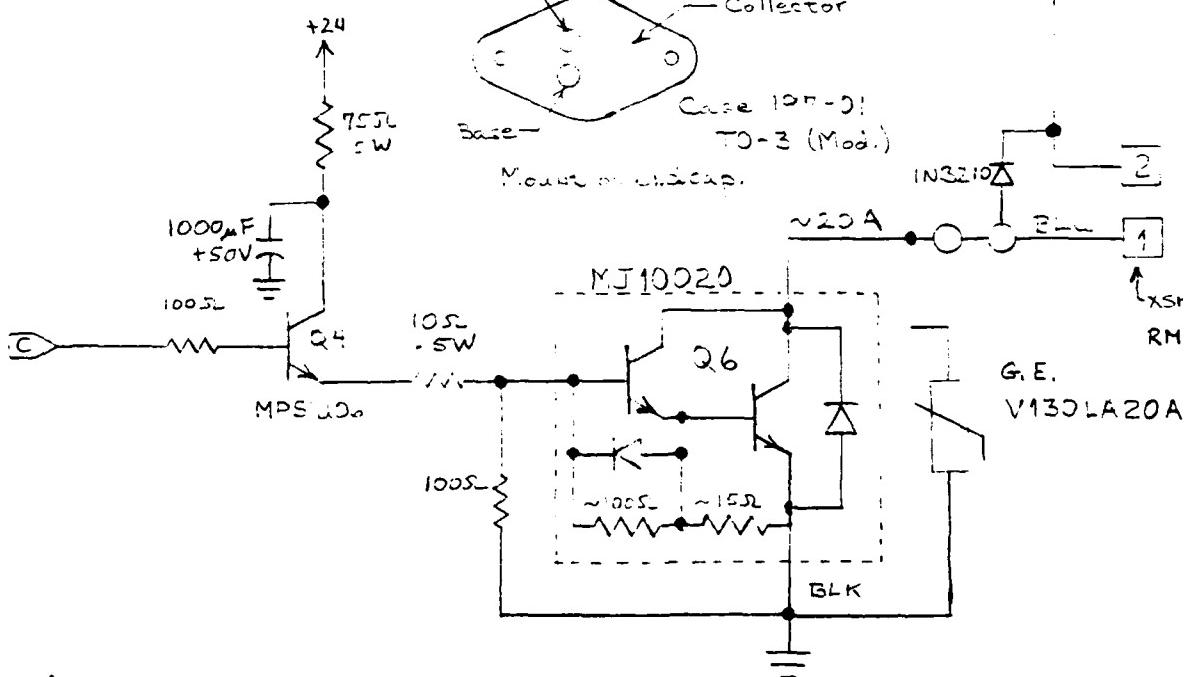
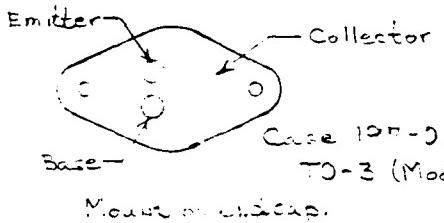
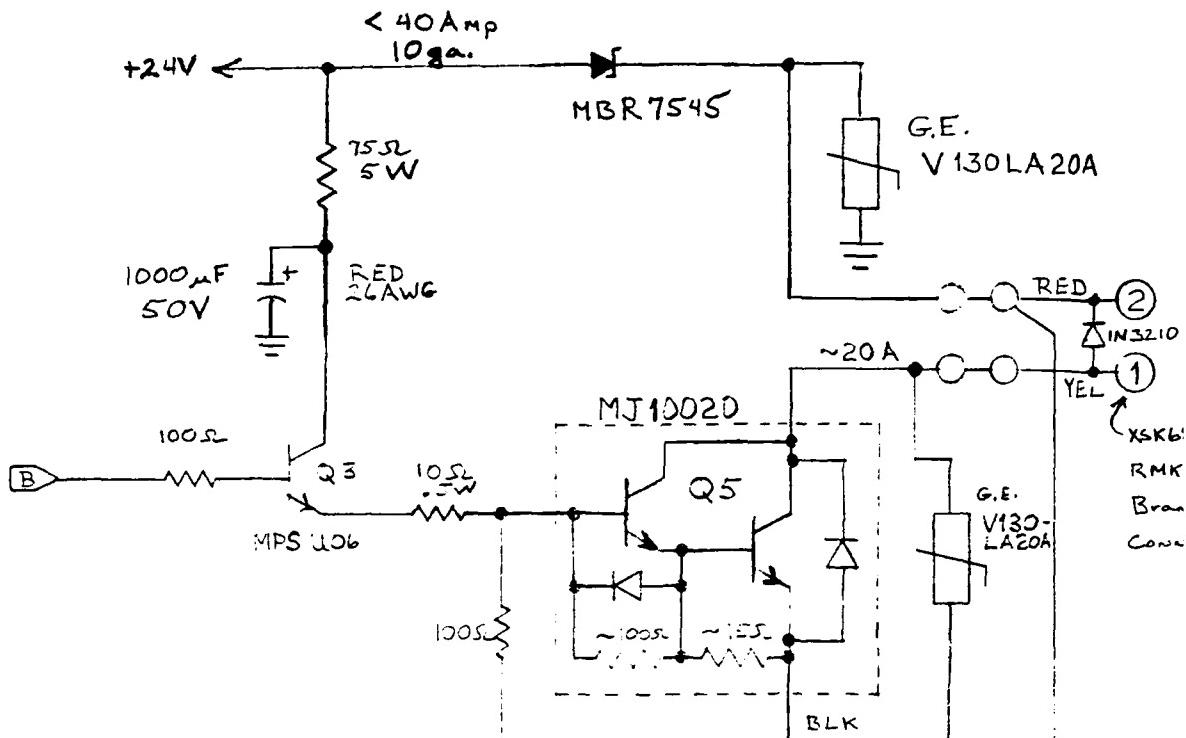
WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE Pump Controller (Control Circuit)	
CONTRACT NO. 10185.69	CODE NO.	Sea Duct	
BY W. TERRY	DATE 27 Feb 86	SIZE B	DWG. NO. SD-B-033
1 OF 3		REV.	

D

C

B

A



Continued From Dwg. SD-B033

2

1

REVISIONS

ZONE

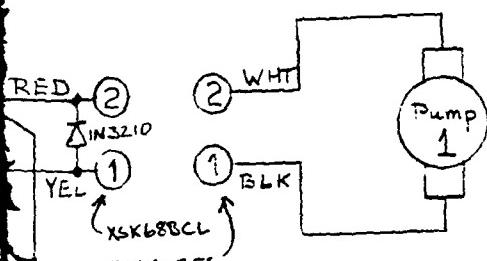
LTR

DESCRIPTION

DATE

APPROVED

A20A

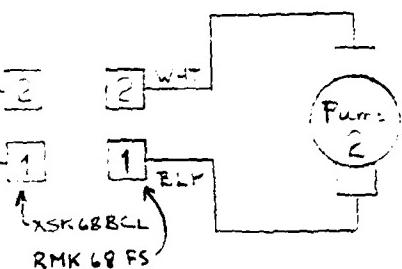


D

C

B

A



JLA20A

REV 26 Nov 86 W.E.T.
REV 23 Apr 86 W.E.T.

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE Pump Controller (Power Circuitry) Sea Duct	
CONTRACT NO.	10/85-69	CODE NO.	
BY L. Terry	DATE 27 Feb 86	SIZE B	DWG. NO. SD-B-034
		2 OF 3	REV.

2

1

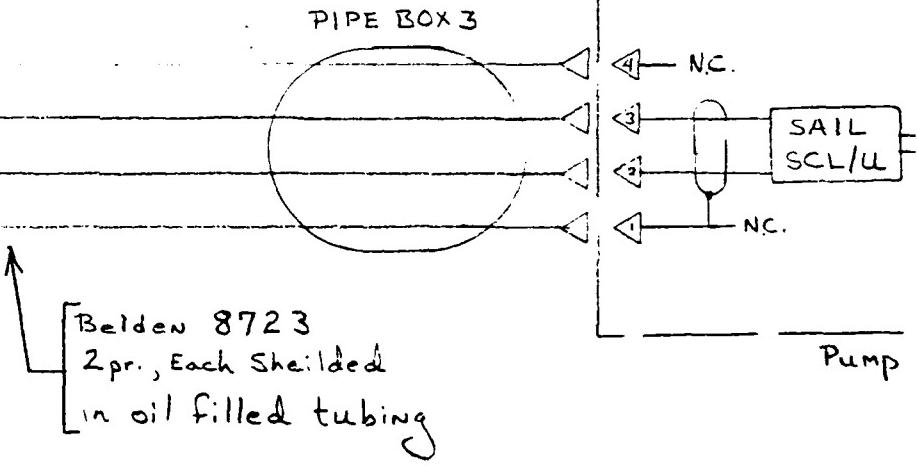
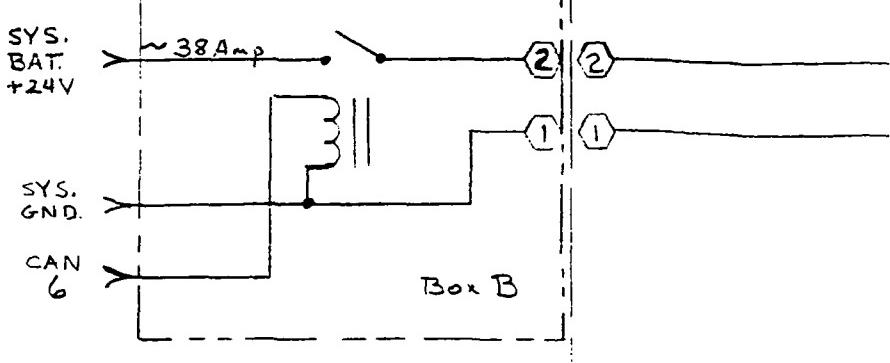
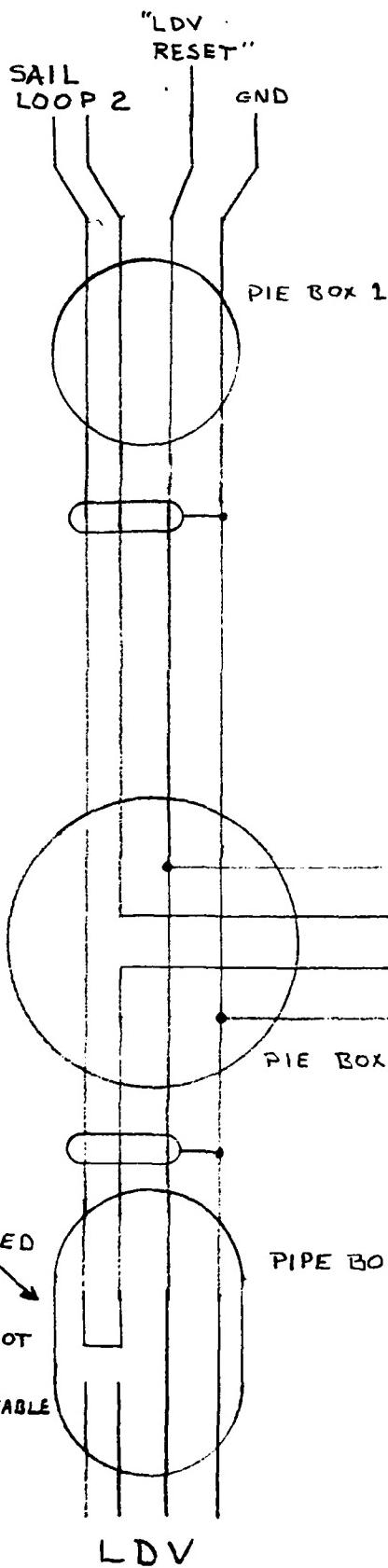
	LM 340 AT5	CA4	CA 2	10. 4040
	<u>IN = OUT</u>			
SOC _{in} F 50V on track	J2	4053	5	104
	12 4093	1052	HD63FG1 M1	M 40103
			1 M	S 40103
SC 2. u	CA 1	S F	1 F	T 40103
			1	104

10/10
 E MFS UOE
 E
 C
 1000L
 4013 CA3 1000L Yaw
 750L SW
 750L SW
 1000L Yaw
 1000L
 4043 E MFS UOE
 1000L

2nd:
 1000m²
 SIV
 in Back

REV 26 Nov 86 W.E.T.
REV 22 Apr 86 L.E.T.

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543		TITLE Pump Controller (Layout)
PROJ. 10/45.69	BY KAWANNO	SD-B-C35
SHEET 3 OF 3	DATE 6 March 86	Sea Duct

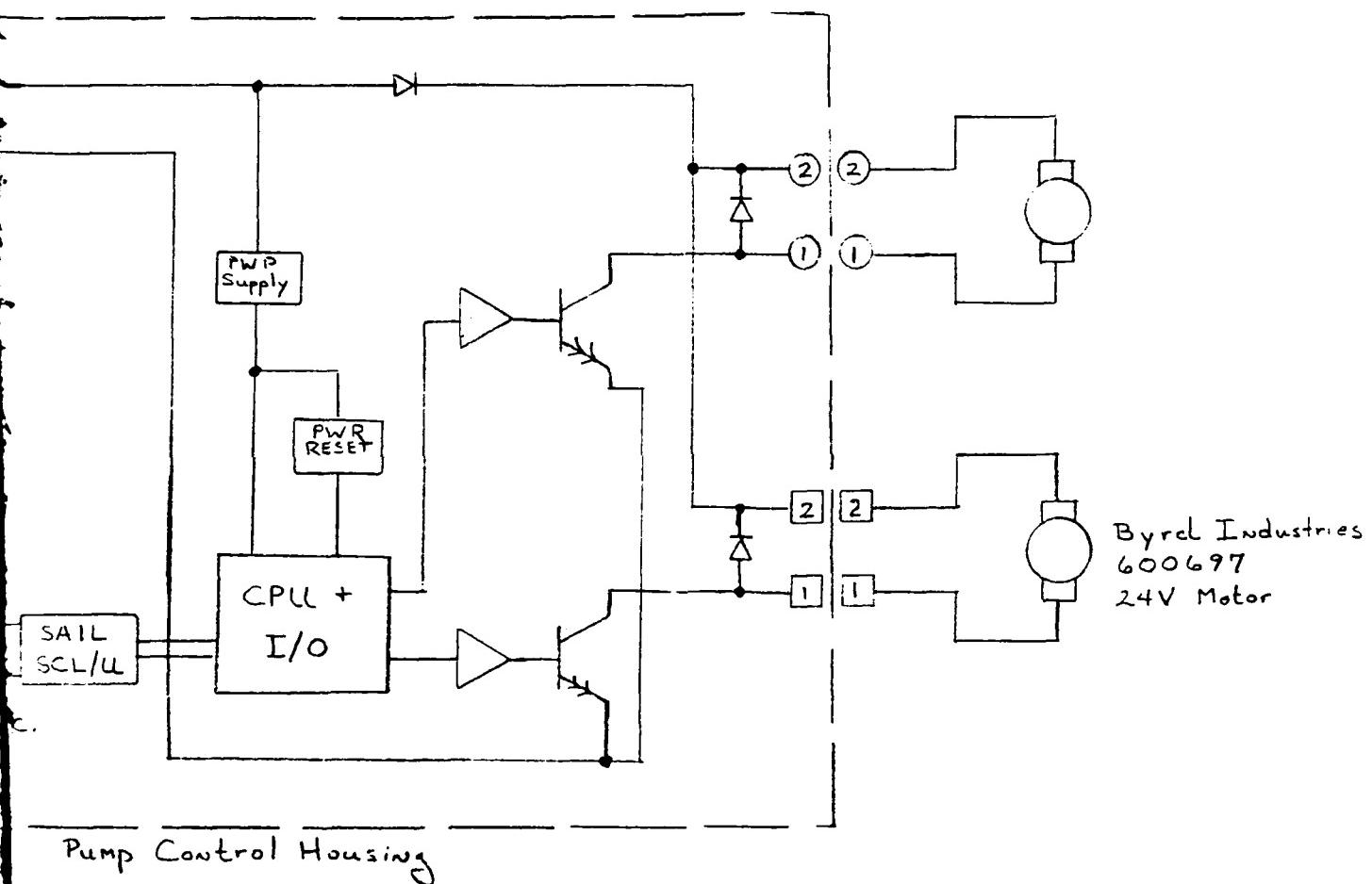


See Dwg SD-BΦ1Φ for cable electrical detail.

WC
 CONTRA
 BY W.

REVISIONS

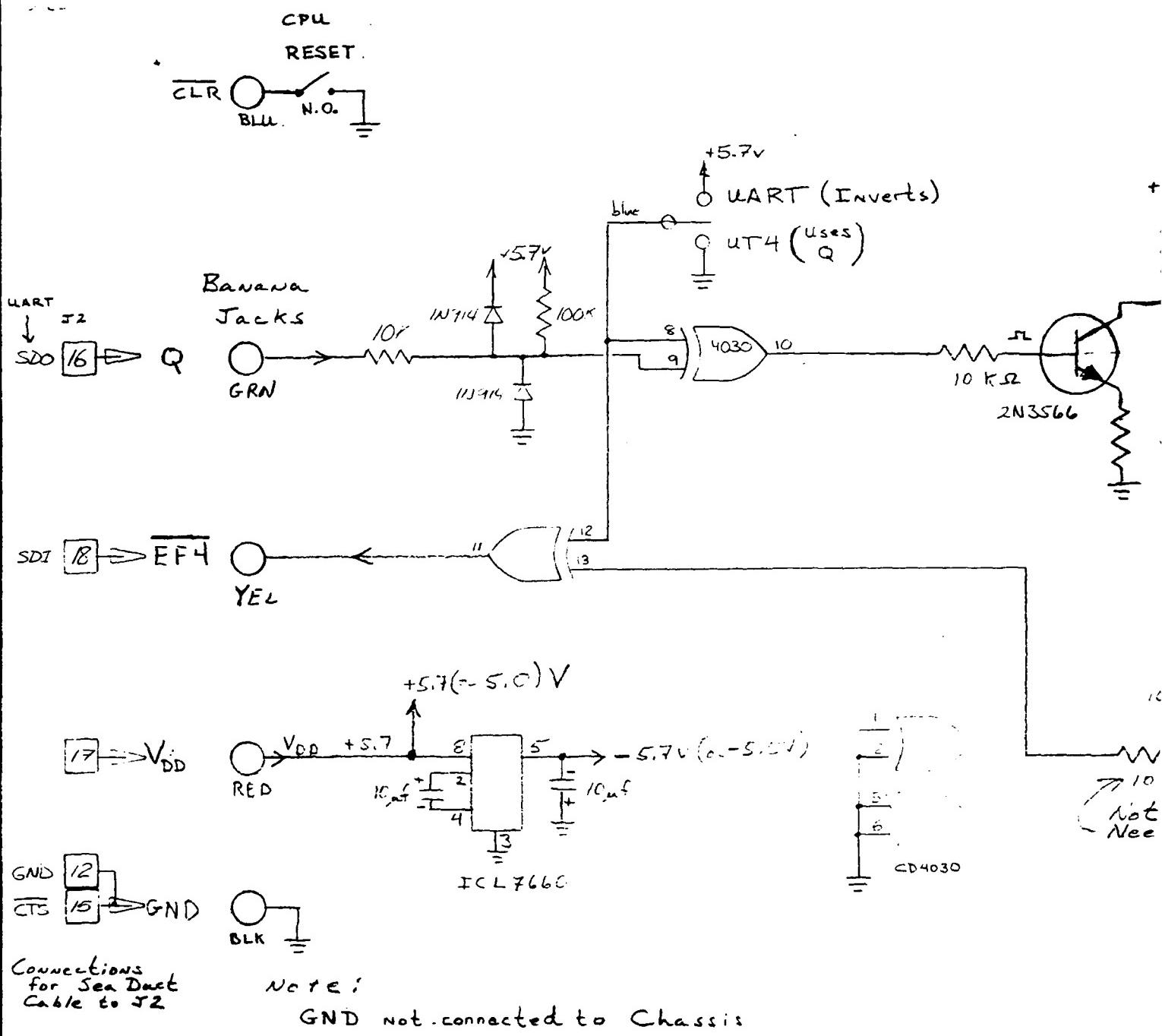
ZONE	LTR	DESCRIPTION	DATE	APPROVED

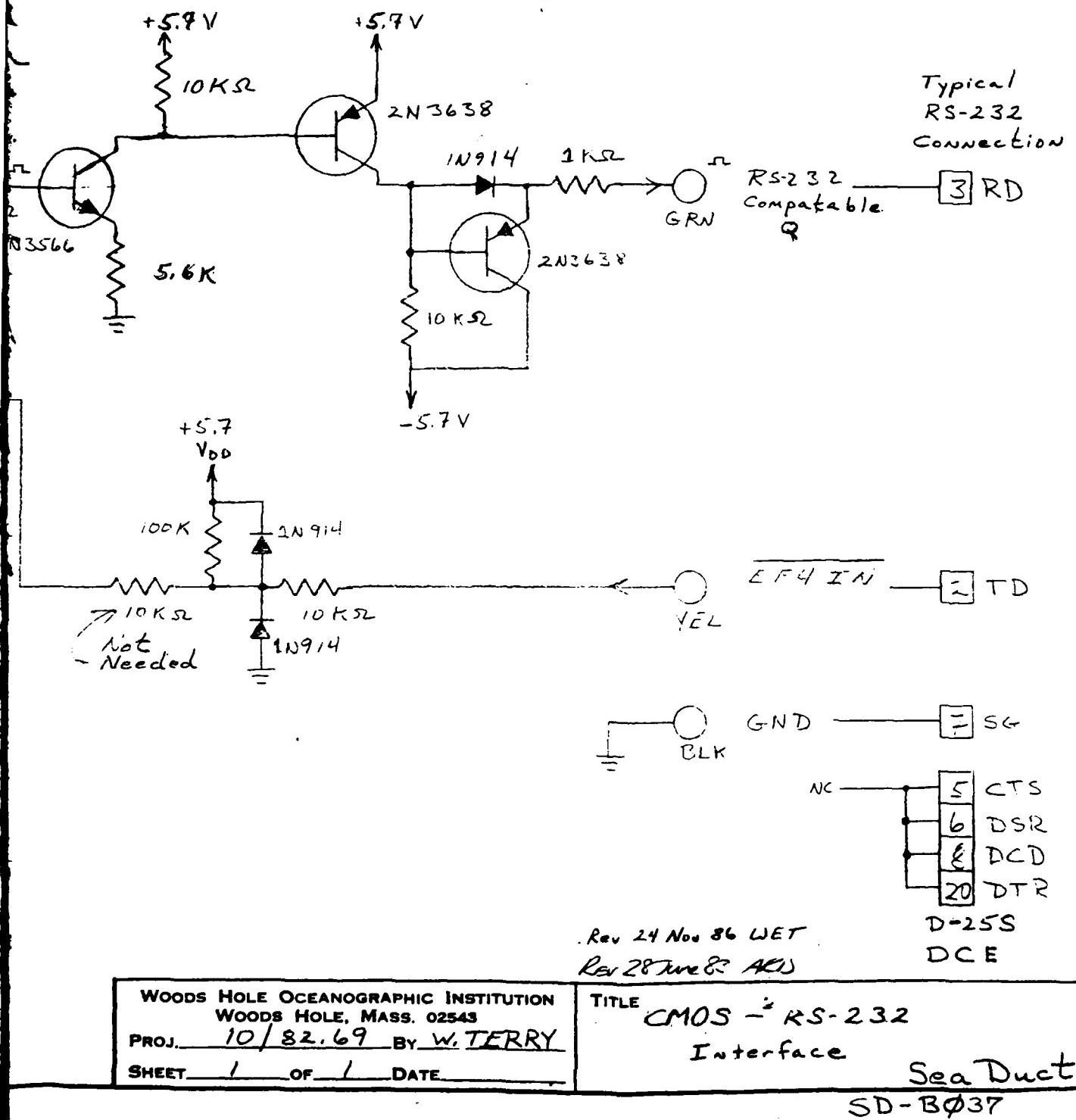


detail.

Rev 26 Nov 86 WET
REV 12 Jun 86 WET

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE Pump Control Block Diagram	
CONTRACT NO.	10/85.69	CODE NO.	Sea Duct
BY W. TERRY	DATE 4 Mar 86	SIZE B	DWG. NO. SD-BØ36
OF	REV. 26 Nov 86		





Note - Pressure Housing is isolated from ground.

Case Gnd. (N.C.)

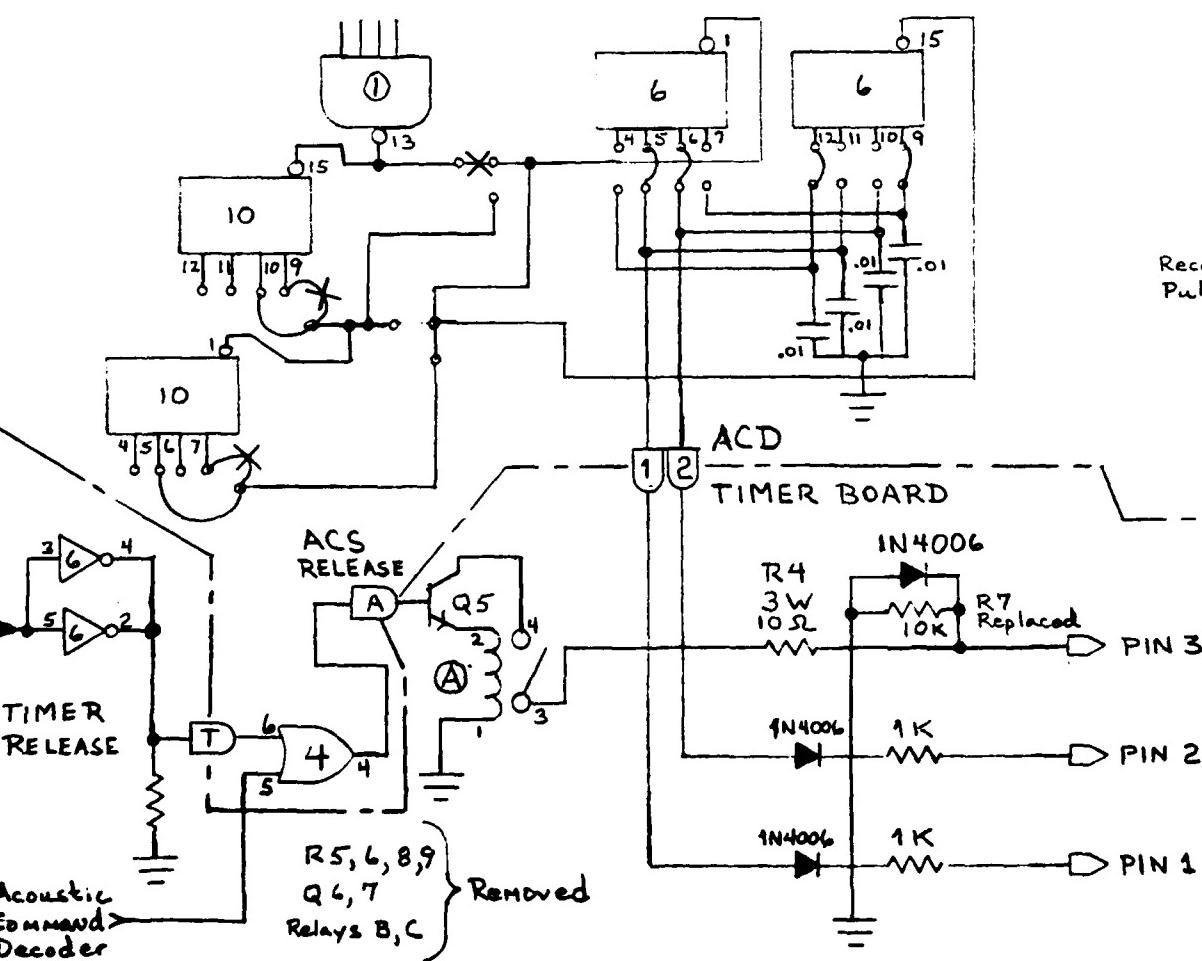
V+ (N.C.)

PIN R "Reset"

GND (Isolated from Case)

PIN T "PING" 1

Acoustic Command Decoder Board (ACD)

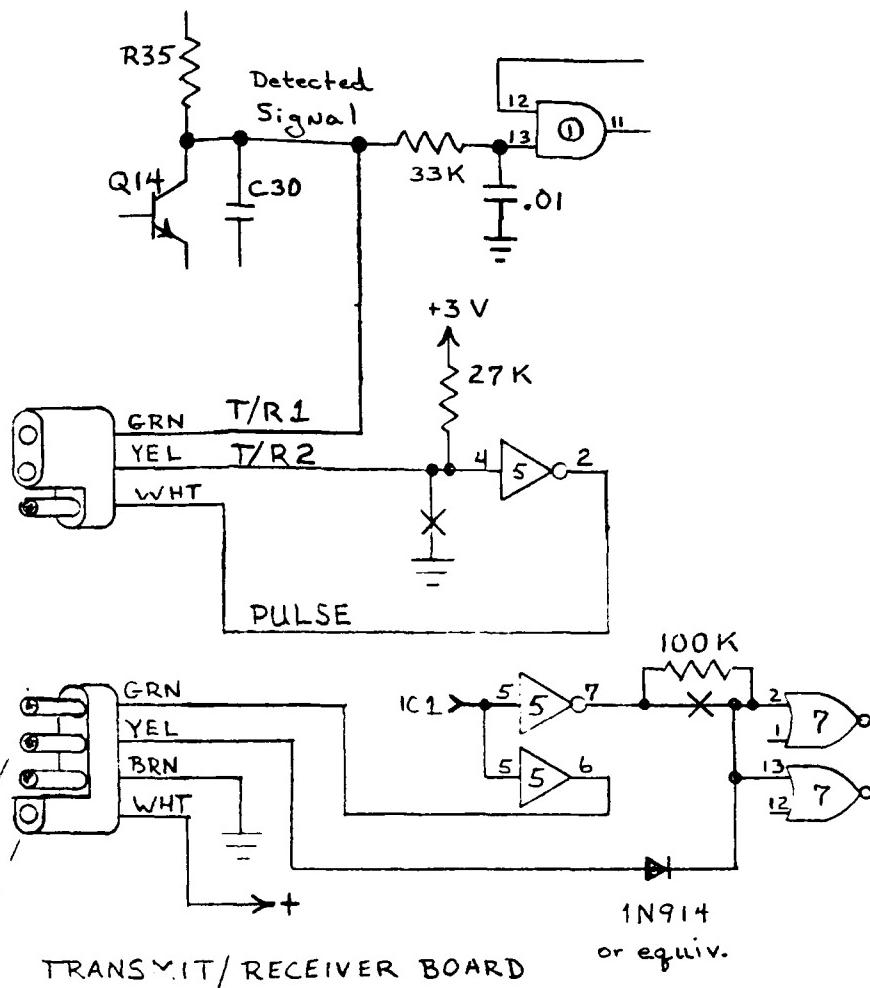
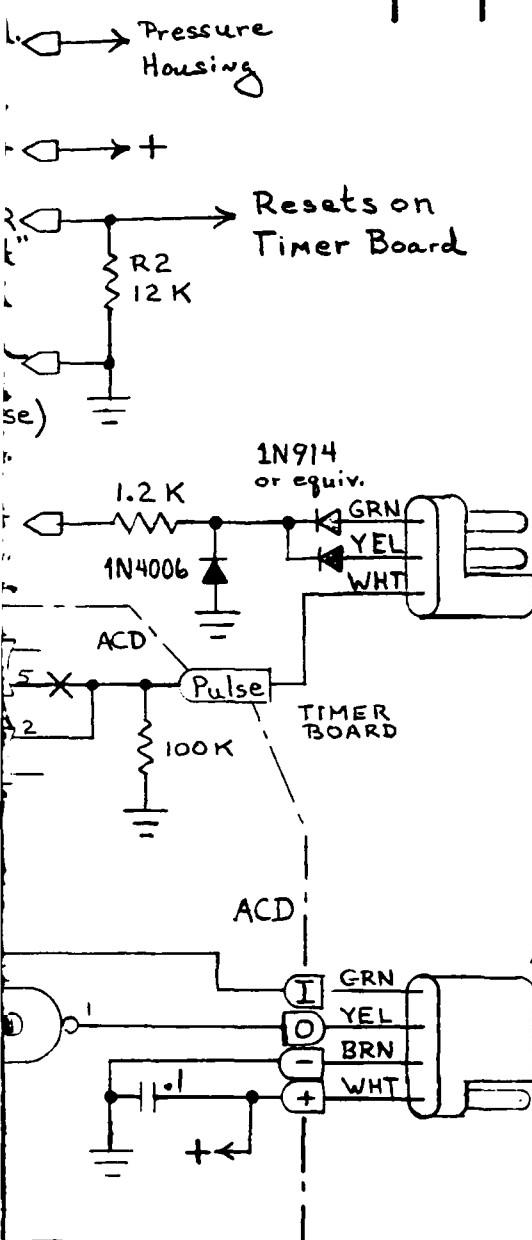


2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



$X = \text{Cut Trace}$

▷ = End Cap Mecca Conn.

D = Transition between boards
(Solder Connection)

ACD = Acoustic Command Decoder (Board)

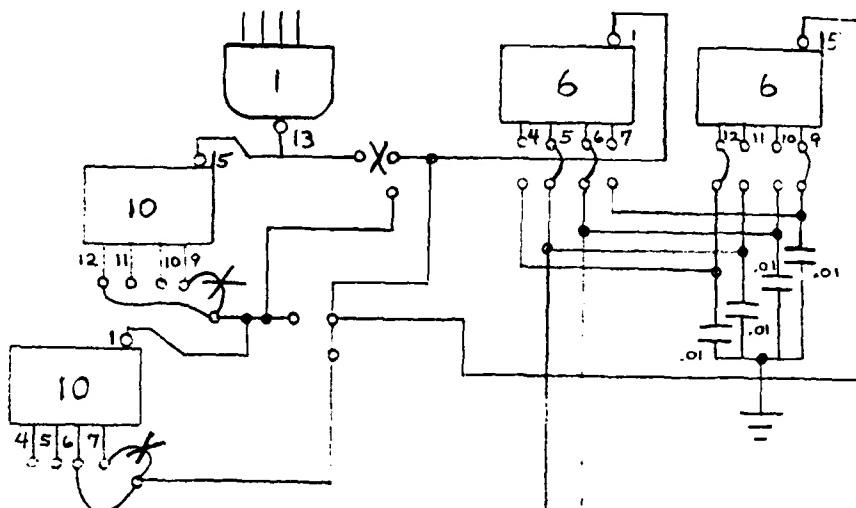
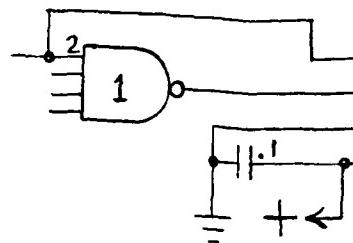
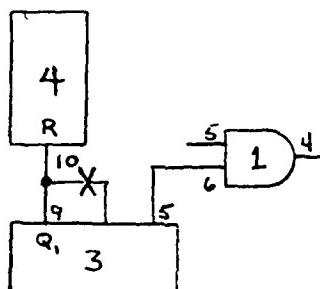
WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE QIS Acoustic Command Xcvr. Modifications Sea Duct		
CONTRACT NO.	CODE NO.	DWG. NO.	OF	REV.
BY W. Terry	DATE 30 Dec. 84 SIZE B	SD-B038		

2

1

P
I
C
I
B
I
A
4

TRANSMIT /
RECEIVE
BOARD



ADDRESS 0010

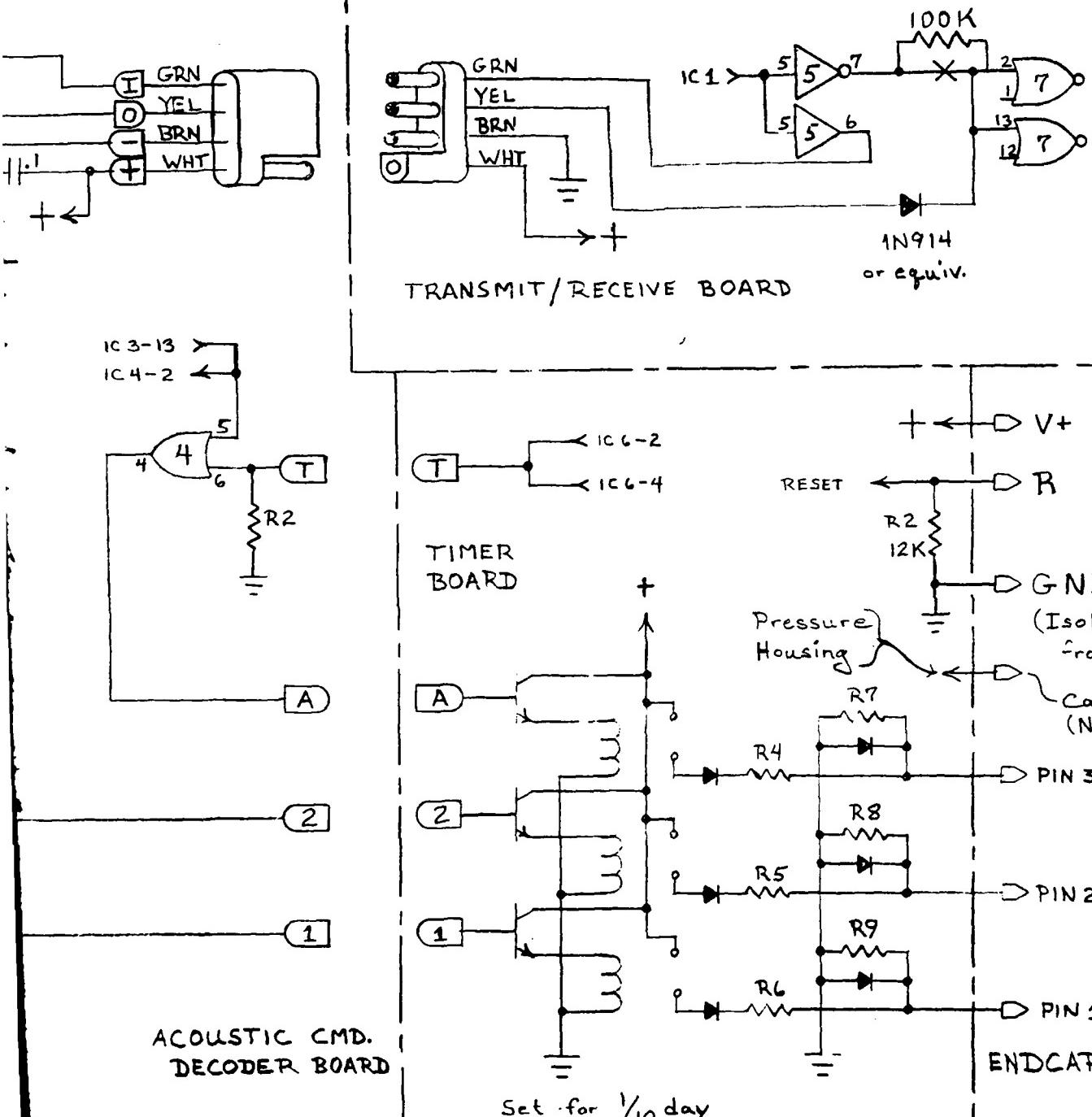
- \times = Cut Trace
- \square = End Cap Mecca Conn.
- \square = Transition between boards
(Solder Connection)

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

TITLE
O.I.S. Acoustic Command Rcvr.
Modifications Sea Duct

CONTRACT NO.

CODE NO.

BY W. Terry

DATE 30 Dec 84 SIZE B

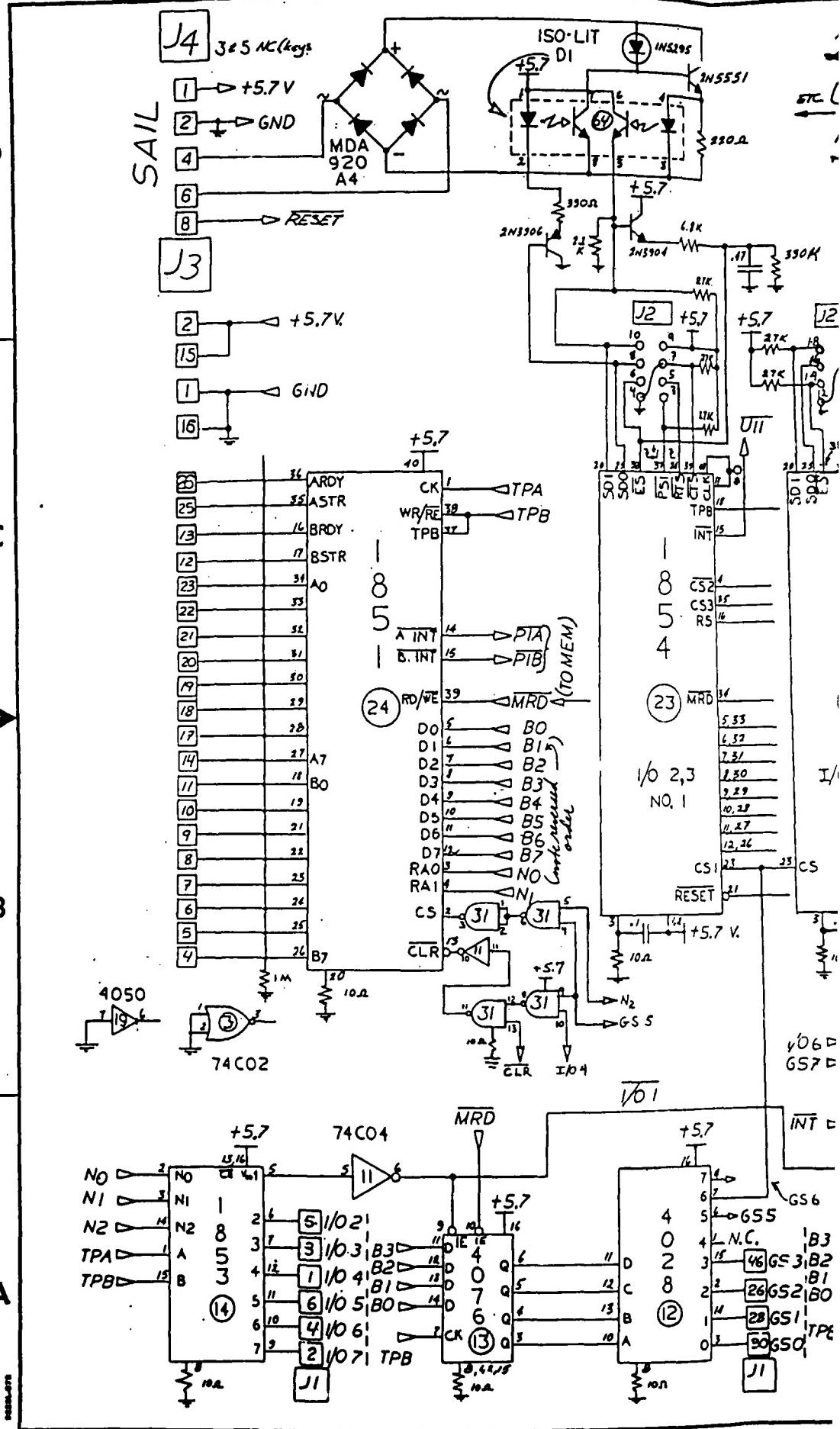
DWG. NO. SD-B039

OF

REV.

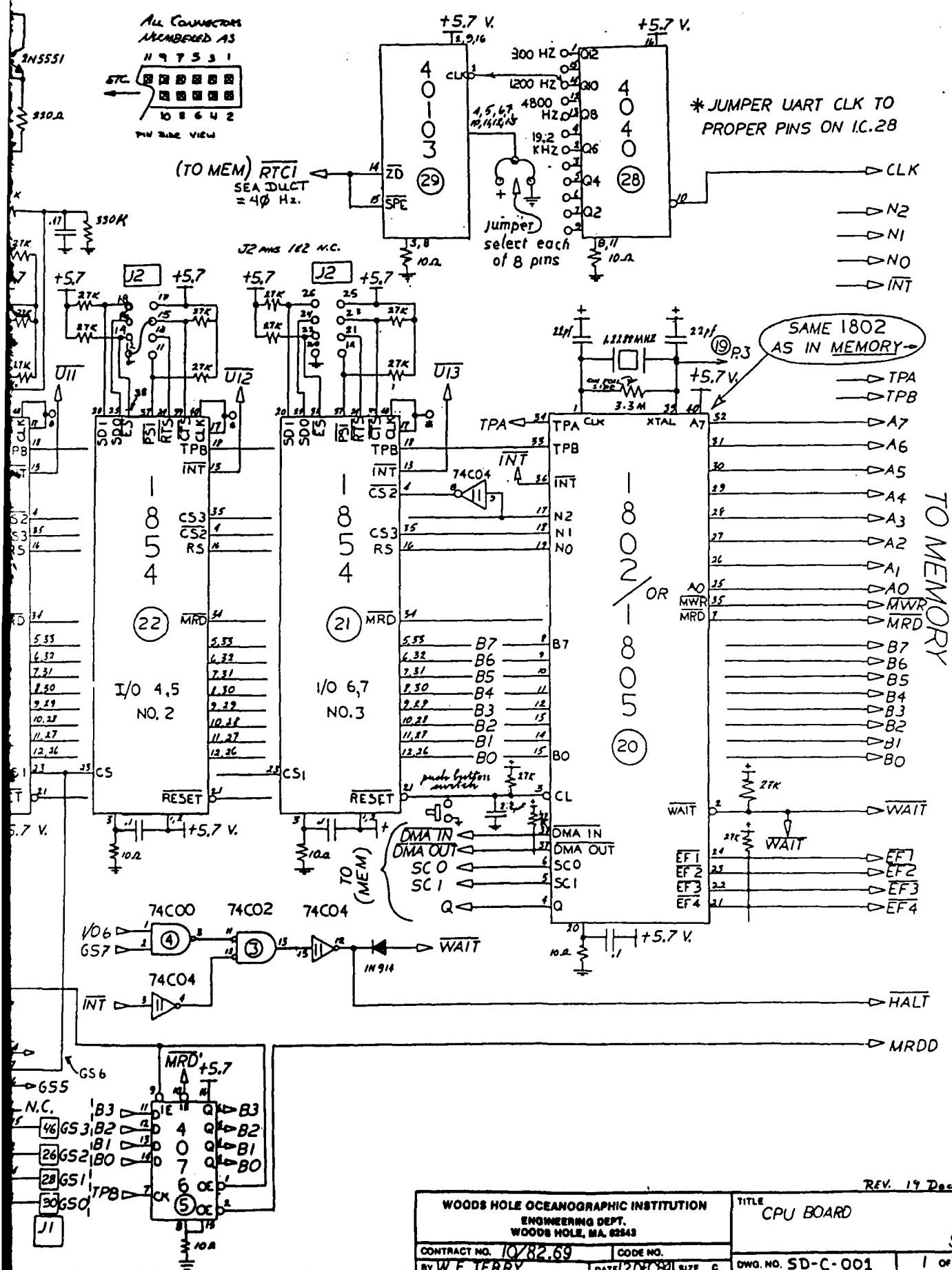
2

1



2

1

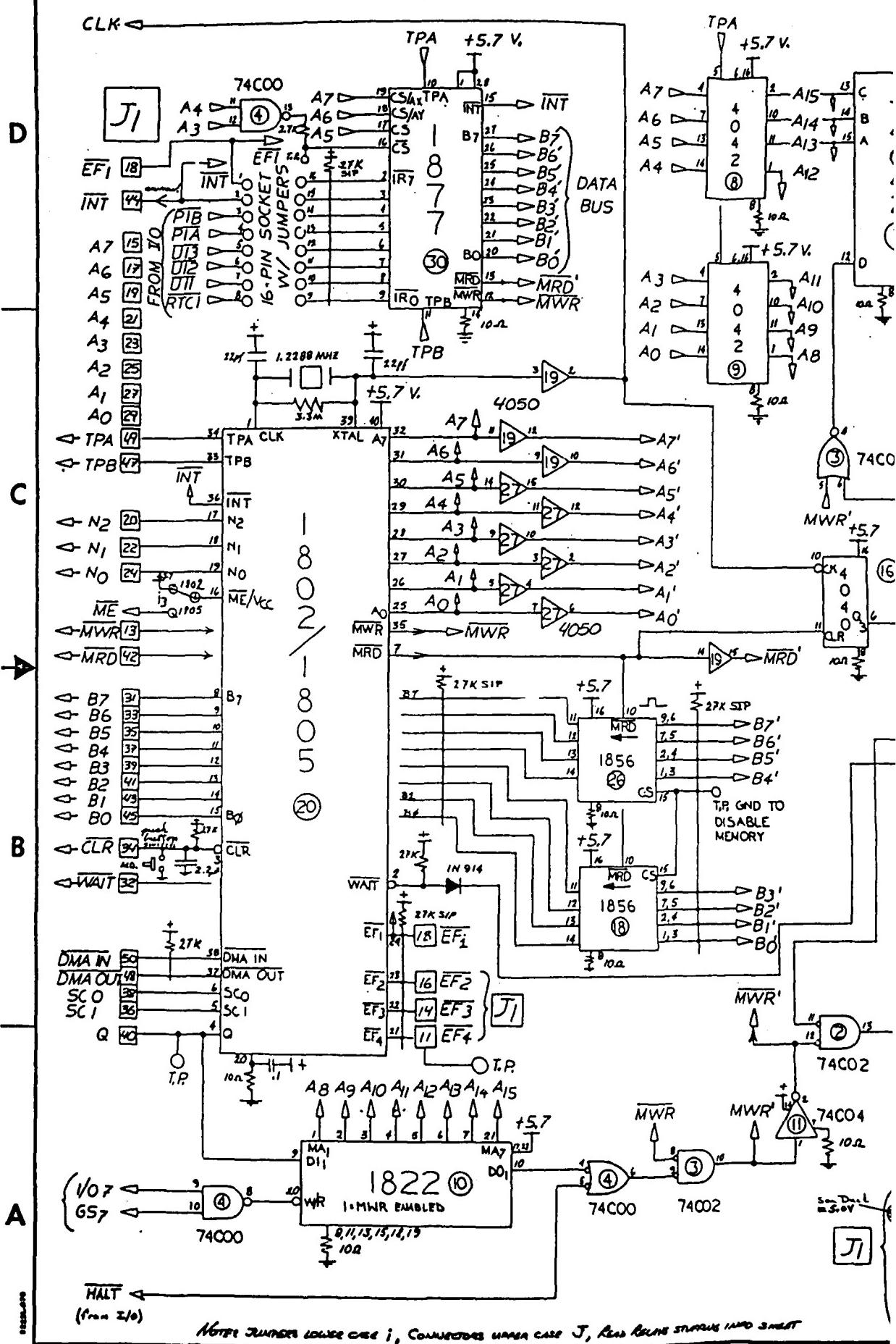


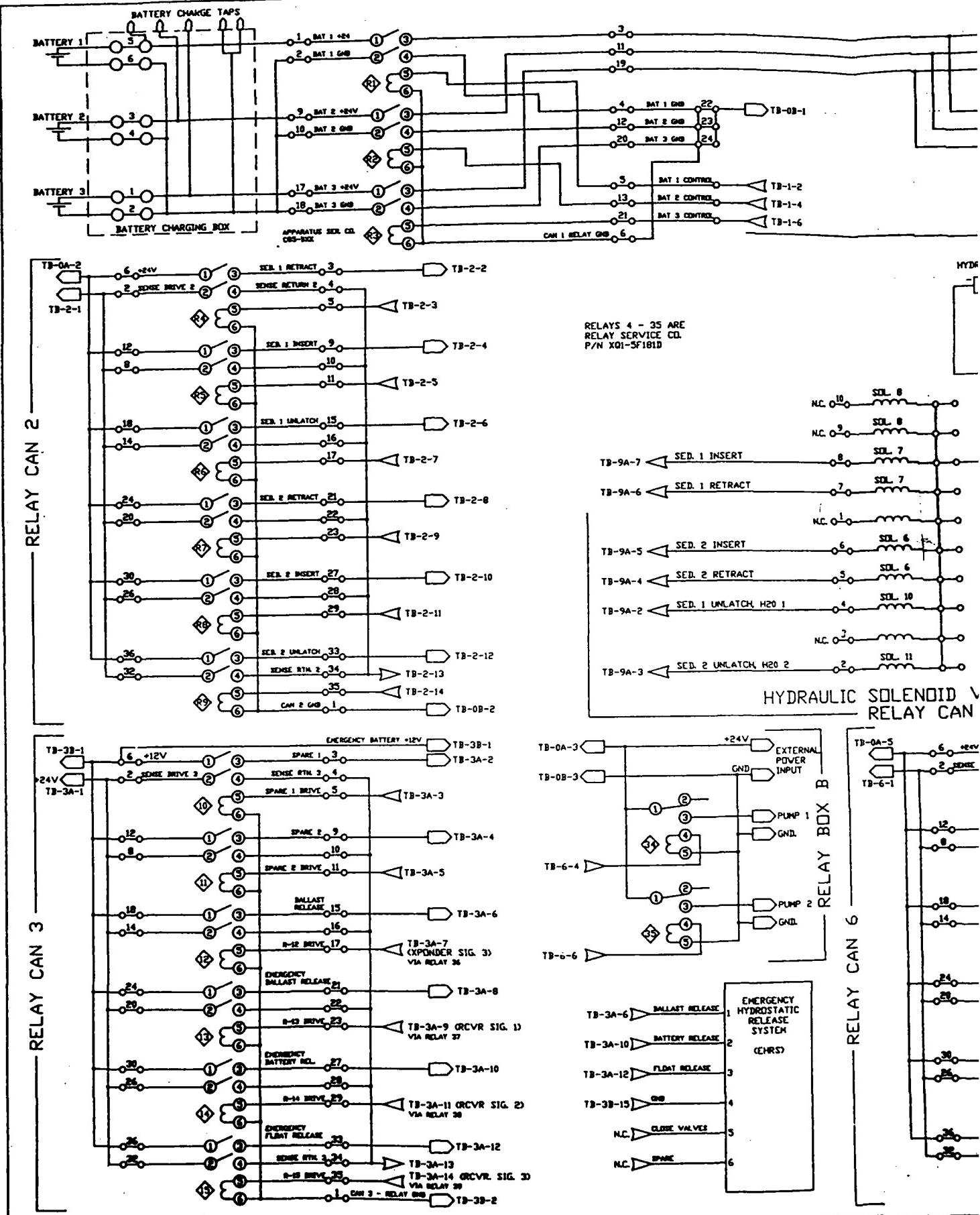
WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

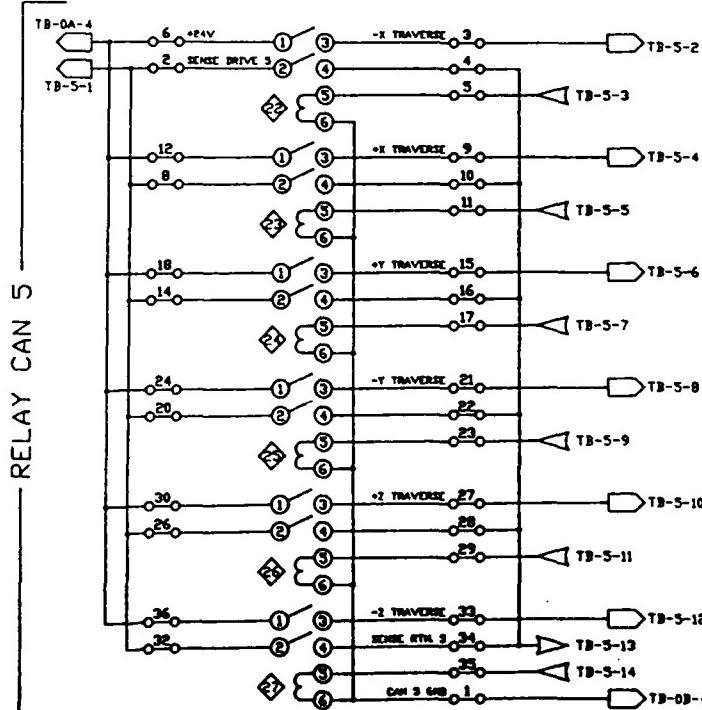
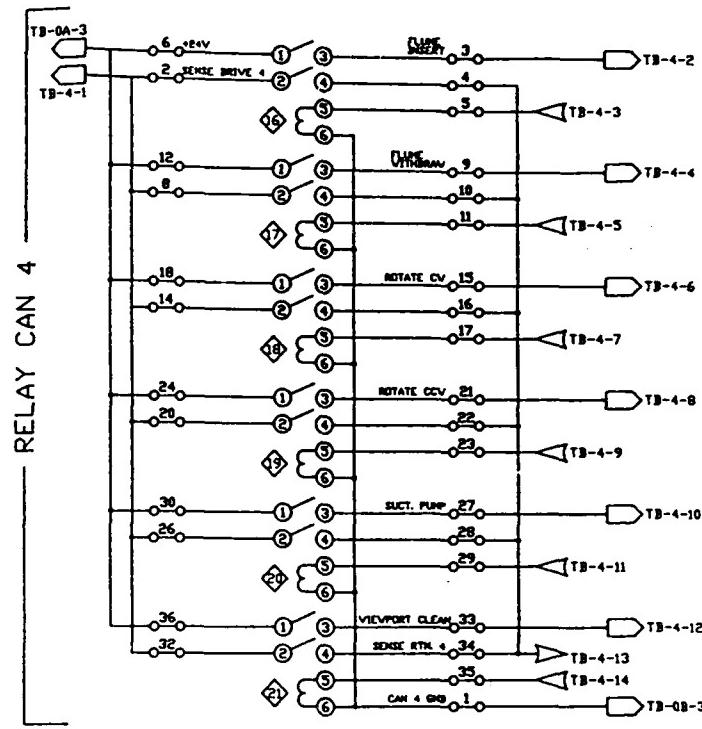
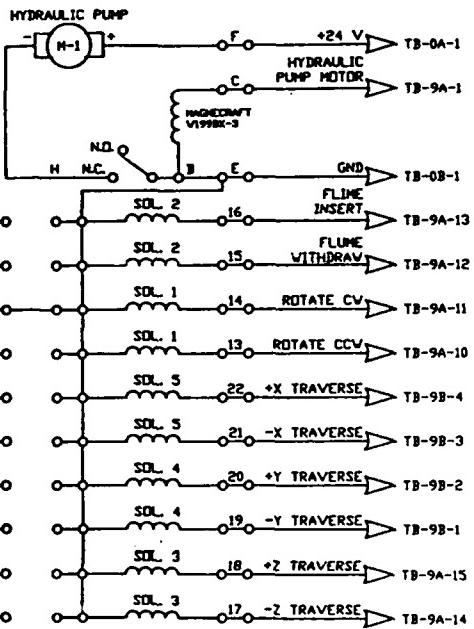
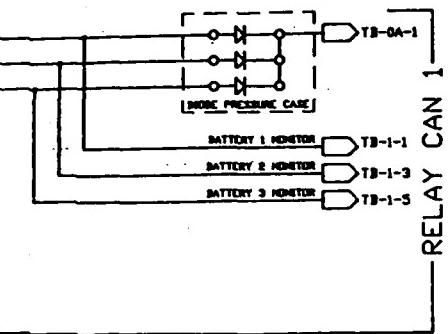
TITLE CPU BOARD

SEA DUCT

REV. 19 Dec. 85 W.E.S.







APPENDIX J

Electronics Manufacturers

Apparatus Service Co.
5 Henshaw St.
Woburn, MA 01801
617-933-5999

Littlefuse, Inc.
800 E. Northwest Hwy.
Des Plains, IL 60016
312-433-2050

Belden - Electronic Wire
and Cable Division
P.O. Box 1980
Richmond IN, 47375
317-983-5200

Litton Systems, Inc.
Encoder Divison
20745 Nordhoff St.
Chattsworth, CA 91311
213-341-6161

Brantner & Associates
1240 Vernon Way
El Cajon, CA 92020
619-562-7070
800-854-2552

Magnacraft Electric Co.
1910 Techny Road
Northbrook IL 60062-5376
312-282-5500

Byrd Industries
P.O. Box 278
Industrial Park
Shelbyville, KY 40065
502-633-1338

Melcher elektronische Geräte AG
Ackerstrasse 56
Postfach
CH-8610 Uster
Switzerland
Telex 57154 MEUS CH
Telephone 01 941 37 37

Carrol Cable Company, Inc.
Pawtucket, RI 02862
401-728-7000

Molex, Inc.
2222 Wellington Court
Lisle, Illinois 60532
312-969-4550

CompuPro
3506 Breakwater Court
Hayward, CA 94545
415-786-0909

Micro Power Systems
3100 Alfred St.
Santa Clara, CA 95054
408-727-5350

Digicourse, Inc.
P.O. Box 50699
New Orleans, LA 70150
504-733-6061

Oceanographic Instrument Systems
Box 766
N. Falmouth, MA 02556

Electrochem Industries
10,000 Wehrle Dr.
Clarence, NY 14031
716-759-6901

Optimal Technology, Inc.
Blue Wood 127
Earlysville, VA 22936

Humphrey, Inc.
9212 Balboa Ave.
San Diego, CA 92123
714-656-6631

Photosea Systems, Inc.
11120 Roselle St.
San Diego, CA 92121
619-452-8903

Potter & Brumfield
P.O. Box 322
Princeton, Indiana 47671-0001
812-386-1000

Relay Service Co.
1310 North Pulaski Rd.
Chicago, Ill. 60651
312-252-2700

Sea Data Corporation
One Bridge St.
Newton, MA 02158
716-244-3203

Sea Tech, Inc.
P.O. Box 779
Corvallis, OR 97330
503-757-9716

Stevens Arnold
7 Elkins St.
South Boston, MA 02127
617-268-1170

Sinclair Manufacturing Co.
Chartley, MA. 02712
617-222-7440

Sprague Electric Co.
87 Marshall St.
North Adams, MA 02147-2484
413-664-4411

Syscon Corp.
5015 Hancock St.
San Diego, CA 92110

Teledyne - Mecca
P.O. Box 36393
Houston, Texas 77236
(713) 772-2811

WET Instrument Systems
P.O. Box 517
Woods Hole, MA 02543

Appendix K

BLT.2 Mini-Monitor Program

BLT, (Bradley-Liberatore-Terry) is an extension and modification of RCA's UT4 monitor. The only I/O used are Q and EF4*. The baud rate is fixed, and an entry at location 0000 (cold start) will give a prompt without typing CR. Some of the extended functions require a modest amount of RAM but BLT checks before using it and will refuse these functions if it can't write in the assigned area.

To install BLT:

1. Find the timing constant and write it into the PROM at M(0108).
300 Baud 1.0000 Mhz. = 14 300 Baud 1.6000 Mhz. = 18
300 Baud 1.2288 Mhz. = 1E 300 Baud 2.0000 Mhz. = 26
2. Select one page of RAM for BLT's use if you need either the subroutine call or CRC functions. BLT will use E0-FF on this page with a stack extending back from DF. The page selected is specified at M(001F).
3. BLT.2 is page relocatable and may be moved if required. Two long branches must be changed in the UT4 part. The bytes to be changed are 01 at M(00D0) and 00 at M(01FD). These are the values for the version that starts at 0000. Add to these values to move to a higher location in memory. If you need to use the \$P entry method with RAMTEST (see section on modification of BLT), you may wish to change the LBR at M(0010) as well.
4. Select the user branch at bytes 0005 and 0006. If EF4* is not held low (true) on entry by an RS232 device, the monitor will jump to the user program via a LBR at 0004. This is usually set to 0800 but can be any value.
5. If the terminal you are using has a narrow screen (H.P. 85) you can shorten the memory dump line length (set to 16 bytes normally) by changing the OF at M(009D) to 07, giving a format of 8 bytes per line.
6. If you can't use EF4*, the monitor can be switched to any other flag by changing the 37's (BF4) at M(0002), M(0153), and M(0161) and the 3F (BN4) at M(0173) and M(014D).

Features of the BLT.2 Mini-Monitor

BLT contains the !M, ?M and \$P commands of UT4. Read the RCA documentation for details. Notice that, although RCA doesn't list it in the register use table, the TYPE routines use an additional scratch location. RCA selected RD.0 but this interferes with alternating calls to TYPE and READH which is occasionally useful. BLT.2 therefore substitutes R8.0 which is "scratched" by all calls to TYPE.

All the BLT added commands are accessed by typing "." (the monitor echos "...") then typing a single letter to select the command. The commands prompt the user for the necessary arguments which are usually addresses or byte counts. The argument rules are similar to those for UT4. When the monitor expects a constant, all non-hex entries are ignored except space and CR, either of which terminate the entry. (Don't use CR since the subsequent reply will overwrite the beginning of the line.) Leading zeros are provided and excess hex digits may be added to correct an entry error since only the last valid hex digits are used. Examples of valid entries are 0001, 20, 3WE5 (=35), ABC34EF2 (=4EF2).

1. .M, block move. Format, "...Move from AAAA to BBBB length CCCC ok?Y" where AAAA, BBBB, CCCC are source start address, sink start address and length to copy. If the reply to "ok?" is not "Y", no move will occur. "Move" copies from low to high address and can get into trouble if the source and sink overlap.
2. .V, Verify. Format, "...Verify AAAA with BBBB length CCCC". This command compares two blocks of memory and list the differences. The format of non equal data is AAAA BB CC DDDD where BB is the byte at AAAA and CC is the byte at DDDD and BB<>CC.
3. .C CRC calculation. Format "...CRC from AAAA over BBBB =CCCC". This calculates a 16 bit CRC check character over the block of memory starting at AAAA of length BBBB. It takes about 15 seconds to do all 65K. It is based on some European standard polynomial for generating CRC's. This command will refuse if there is no RAM in the system.
4. .S Subroutine. Format "...Subroutine AAAA DD DD X". This command invokes a SCRT call to a routine at AAAA, passes it in-line data, DDDD, and expects the subroutine to return via a D5 instruction (standard RCA call and return using R3=pc, R4=call, R5=return, R6=immediate bytes pointer and R2-stack pointer). The in-line-data is optional but will run out of buffer if longer than 28 bytes. For this one command, spaces are allowed between bytes hence the terminator "X" must be used to invoke the command. Any other non-hex entry will abort the command and return to the prompt. After the return from the user subroutine, the monitor re-initializes all it's registers so there are no restrictions on register use (other than those used by SCRT itself.) The stack is set up on the ram page starting at location DF. This command will abort if no RAM is present in the system.
5. .R Ramtest. Format "...Ram test start at AAAA over BBBB". Ramtest tests an area of RAM starting at AAAA by writing a pseudo-random sequence BBBB bytes long, then checking the entire area on a second pass. It is very good at finding obscure "connected cell" errors. Every good pass causes an "*" on the terminal. Each subsequent pass uses the sequence shifted over one bit so several are required to catch all bit locations. When RAMTEST finds an error, it lists the XDR of the data it wrote and read along with the address where the error occurred.

Modifications to BLT.2

There are several attractive alternative configurations of BLT. First, if memory is at a premium, the first two pages alone can be used to give a self-starting version of UT4 which can be re-entered at 0000 with X=P=0 or 0007 with only P=0 to elicit an immediate prompt. Similarly, RAMTEST is totally contained on the third page and will work with UT4 as a 3 page package. To enter RAMTEST without the rest of the monitor, use \$P10. If you use either of these truncated versions, you should delete the extended command test branch added to UT4. The easiest way to do this is to change the 3A (BNZ) at M(001C) to 30 (BR).

It's easy to add more functions to BLT.2 as well. Study the code at 0592-059A then add more tests by changing the jump at 059A. Notice that the letter entered as a response to the "..." extended prompt is stored at RF.1 and that the "no match" return is through 0522. Notice also that P=R4 at this time. If your routine is used, return through the "warm start" location, 0007, with P=0 to re-initialize the registers required for the monitor's use. There is a small text handling subroutine included with BLT (called QTTY) that runs in R5 and starts at 04A1 which may be handy if you need some prompting for your extension. Read the source file for details. Remember the bit about all TYPE calls (QTTY calls TYPE) scratching R8.0.

RCA Format listing for BLT2

```

!M ;
0000 7100 3707 C008 00F8 02BE 2E9E 3A0A 3029; User Branch
0010 C002 F6FF FFFF FFFF FB11 3A42 F857 LBR for Ram Test
0020 B295 FC03 B4F8 06A4 D490 B5B3 F830 A5D5; Ram page select
0030 E571 55C4 C4F8 FEAE D3F8 9CA3 D30D D30A; Sea Duct = 57
0040 D32B F800 ADBD F83B A3D3 FB24 32D6 FB05;
0050 A1CE FB1E 3A1A D3FB 4D3A CAD3 3B5B D333;
0060 5EFB 203A CA9D B08D A081 32B4 F800 ADBD;
0070 D333 70FB OD3A CAF8 9CA3 8DA1 9DB1 D30A;
0080 90BF F8AE A3D3 80BF F8AE A3D3 D320 40BF;
0090 F8AE A3D3 2181 3A9B 9132 3980 FAOF 3AA6;
00A0 D33B D30D 307E F633 8E30 8CD3 3BAB D33B;
00B0 CA8D 5010 D333 AEFB OD32 39FB 2132 ABFB;
00C0 173A B4D3 FB0D 3AC3 305B F89C A3D3 0DC0;
00D0 01F8 0000 0000 D3FB 503A CAD3 33DB FB0D;
00E0 3ACA 9DB0 8DA0 F89C A3D3 0AE5 7100 D39E;
00F0 F6AE 2E43 FF01 3AF4 8E32 EE23 30F2 93BC;
0100 F800 AEEA F8EF ACF8 18BE F839 A530 2EFF;
0110 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
0120 FFFF FFFF FFFF FFFF FFFF FFFF FFFF D5FC;
0130 0733 37FC 0A33 87FC 009F D5F8 0038 83C8;
0140 F801 AFF8 80BF E38F F63B 4D38 803F 4D37;
0150 4FDC 0237 4F8F F63B 5B38 40E2 C49E F633;
0160 6837 667B 3068 7AC4 DC07 C4C4 9FF6 BF33;
0170 78F9 803F 5BBF 305D 7A32 438F 3A39 9FFF;
0180 413B 2FFF 0633 37FE FEFE FEFC 08FE AE8D;
0190 7EAD 9D7E BD8E FE3A 8E30 3900 DC17 38D5;
01A0 4538 4638 9FAE FBOA 3ABF F88B 30C1 9FF6;
01B0 F6F6 F6FC F63B B9FC 07FF C6AE F81B C8F8;
01C0 0BAF 7B8E A8DC 072F F588 76A8 33D1 7B30;
01D0 D37A C48F FAOF C4C4 3AC5 8FFC FBAF 3B9F;
01E0 FF1B 329F 3BEA F800 30F5 9FFA 0FFC F63B;
01F0 F3FC 07FF C6AE 30C2 D30A D33F C000 3947;
0200 90B5 F8BB A5D5 0000 0000 0000 0000 0061;
0210 6D20 7465 7374 2073 7461 7274 2061 7420;
0220 9DF9 9DBB 8DAB D56F 7665 7220 9DFF C4C4;
0230 97B8 9BB9 8BA9 9DBA 8DAA F898 A5D5 98C4;
0240 5919 2A8A 3A3D 9A3A 3DC4 97B8 9BB9 8BA9;
0250 9DBA 8DAA D5E9 98F3 3A70 192A 8A3A 549A;
0260 3A54 97B8 D598 B7F8 BBA5 D52A FF30 30FF;
0270 A8F8 BBA5 D50D 0A00 0000 0000 FF88 BFD5;
0280 8120 6174 20FF 99BF D581 FF89 BFD5 81FF;
0290 F898 A530 5AFF FFDD F800 A898 3AA1 F8FF;
02A0 B8F6 3BA5 18F6 F63B AA18 F63B AE18 F63B;
02B0 B218 88F6 9876 B830 97FF D040 A7FA 803A;
02C0 C9F8 A4A3 87BF D330 BB87 FBFF 32BA 87FB;
02D0 813A D8F8 AEA3 30C6 87FB 9D3A C130 EDFF;
02E0 D39F FB20 3AE0 F89C A3D3 2030 BBF8 00AD;
02F0 BDF8 3BA3 30E0 F810 BA2A 9A3A F930 002F;

```

R8.0 scratched by 'type'

Page Dependent

Ram Test Routine

- * Page independent
- * Enter \$P 2F6 from UT4
- * Enter ...R from BLT2

Ram Test entry point

BLT additions to UT4

0300 B4FF FFFF FFFF 94FC 01B5 F8A1 A5C4 D5DD;
0310 2E2E 9ADD 00C4 9FFB 4D32 30FB 0E32 70C4;
0320 FB15 32C2 30FE 94FF 03B0 F807 AOE0 DOFF;
0330 D5DD 6F76 6520 6672 6F6D 209D 00C3 FFFF;
0340 9DBA 8DAA D574 6F20 9D00 9DBB 8DAB D56C;
0350 656E 6774 6820 9D6F 6B3F 9A00 9FFB 59C4;
0360 3A26 4A5B 1B2D 9D3A 628D 3A62 30EA FFFF;
0370 D5DD 7263 2066 726F 6D20 9D00 9DBA 8DAA;
0380 FFFF D56F 7665 7220 9D00 F8E2 A2F8 6DA5;
0390 D533 26F8 00BB 7352 FFFF 0AFB FFCE BBC4;
03A0 D52D 9D3A 9A8D 3A9A F8A1 A59B 32B9 92BD;
03B0 82AD D53D 8D8D 0030 26D5 436C 6561 7200;
03C0 3026 D5DD 6572 6966 7920 9D00 9DBA 8DAA;
03D0 D5DD 7769 7468 209D 009D BB8D ABD5 DD6C;
03E0 656E 6774 6820 9D00 30FF D5DD 0700 3026;
03F0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF 38C8;
0400 30FE 9D3A 148D 3A14 D5DD 2064 6F6E 6500;
0410 3022 FFFF EBOA F33A 261A 1B2D 3002 FFFF;
0420 FFFF 94FF 01B4 D50D 0A00 F84B A5FC 009A;
0430 D58A D5F6 D50A D5F6 D50B D5F6 D59B D58B;
0440 D5F8 A1A5 3019 FFF8 02F6 D433 54BF F8AE;
0450 A3D3 3047 F820 BFF8 A430 50FF FFFF FFFF;
0460 FFFF FFFF FFFF FFFF FFFF FFFF FFFF 7352;
0470 E2F3 3277 FF00 C8FC 00D4 E24A F322 52F6;
0480 F6F6 F6F3 52FE FEFE FE60 60F3 2273 72F6;
0490 F6F6 F373 FOFE FEFE FEFE F360 6073 3079;
04A0 D404 3AA7 1430 A0FB 8A3A B4F8 A4A3 D314;
04B0 30A1 FFFF FB07 3AC0 4DBF F8AE A330 AEFF;
04C0 FB02 3ADO 30BA FB40 32EC FBDD BF30 ABFF;
04D0 FB15 3ADA F83E A330 AEFF FB07 3AC6 F800;
04E0 BDAD F83B A3D3 9FFB 203A E5C4 9EFE FEEA;
04F0 8E32 AF2E C430 FOFF FFFF FFFF FFFF 38C8;
0500 3092 FFFF FFFF D5DD 7562 726F 7574 696E;
0510 6520 00C4 F86D A5D5 3322 94B5 F87C A5C4;
0520 3028 94FF 02B4 FFFF F8E0 A2F8 D452 12D5;
0530 9FFB 583A 22F8 D552 C4C4 F8DF A294 B6C4;
0540 F870 A692 B3F8 EOA3 94B5 F861 A5C8 FFFF;
0550 D3E2 8673 9673 93B6 83A6 46B3 46A3 3050;
0560 D396 B386 A3E2 1272 B6F0 A630 60FF FFFF;
0570 93FF 05B0 F807 AOE3 7100 FFD4 F83B A3D3;
0580 3B8A D33B 8A8D 5212 307F 9FFB 2032 7C30;
0590 7BFF 9FFB 5332 06FB 013A 2294 FF03 B0C4;
05A0 F8F6 AOE0 DOFF FFFF FFFF FFFF FFFF FFFF;
05B0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
05C0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
05D0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
05E0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
05F0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF

Locations 0600 - 07FF are also empty.

Appendix L

BTU Monitor Program Listing

The BTU Monitor program runs automatically when the CPU is reset. A description of this monitor may be found in the software section.

```
2
3
4 ;SAIL BASIC MONITOR PROGRAM
5
6
7 ;SUBTTL BTU SAIL MONITOR      20 FEB 1986      BTU2.MAC
8
9 ;PREVIOUS VERSION:      13 FEB 1985      BTU2.MAC
10
11 *****
12
13 ;SEA DUCT VERSION - Easily adaptable for other 1305A/6A SAIL systems
14
15 ;*** UNLOCKED SYSTEM VERSION !!! ***
16
17 ;*** DOES NOT USE INTERRUPTS !!! ***
18
19 C     INCLUDE I1806A ;include file for i806A opcodes
20 C     I1806A.MAC - Macro Definitions for RCA 1305A/6A Opcodes
21 C
22 C
23 C     20 FEB 1986
24 C     W. E. TERRY
25 C
26 C     (LISTING SUPRESSED)
27 C
28 C     With some Level II codes
29 C
30 C     .LIST
31 C
32 C     FOR RCA 1305A/6A
33 C
34 C     W. E. TERRY
35 C
36 C
37 ***** REGISTER ALLOCATION *****
38
39 ;***** SAIL *****
40
41 0000    DMA   EQU 0 ;DMA IN/OUT      ALSO START
42 0001    INTPC EQU 1 ;INTERRUPT PROGRAM COUNTER
43 0002    STACK  EQU 2 ;UTILITY STACK
44 0003    PC    EQU 3 ;MAIN PROGRAM COUNTER
45 ;        4 ;SCRT CALL
46 ;        5 ;SCRT RETURN
47 0006    RTNPTR EQU 6 ;POINTER FOR RETURN & IMMEDIATE BYTES
48 0006    LIST   EQU 6 ;
49 0007    GPAGE  EQU 7 ;GLOBAL PAGE      S.O & R.O
50 0008    CYCCNT EQU 8 ;REAL TIME CLOCK CYCLE COUNT
51
52
53 ;***** I/O SELECT *****
54
55 0001    GROUP  EQU 01 ; SELECT = OUT 01
56 ;           ; READ = INP 01
```

MACRO-18 3.36 PAGE 1-1
 BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

```

57      ;
58      ;
59      ; ***** GROUP 6 - UARTS *****
60      ;
61      0006      UARTS EQU 06 ; UART GROUP
62      0012      FORMT1 EQU 12H ; 7 DATA BITS, 1 STOP BIT, EVEN PARITY
63      ;
64      ;
65      ; <INPUT>
66      ;
67      0002      DATA1 EQU 02 ; LEVEL 1 SAIL UART
68      0003      STAT1 EQU 03 ; LEVEL 1 SAIL UART
69      0004      DATA2 EQU 04 ; LEVEL 2 SAIL UART
70      0005      STAT2 EQU 05 ; LEVEL 2 SAIL UART
71      0006      DATA3 EQU 06 ; NOT USED
72      0007      STAT3 EQU 07 ; NOT USED
73      ;
74      ; < OUTPUT >
75      0003      CTRL1 EQU 03 ; LEVEL 01 SAIL UART CONTROL
76      0005      CTRL2 EQU 05 ; LEVEL 02 SAIL UART CONTROL
77      0007      CTRL3 EQU 07 ; NOT USED
78      ;
79      ;
80      ; ***** GROUP 7 *****
81      ;
82      0007      SYSTEM EQU 07
83      ;
84      ; < INPUT >
85      ;
86      ; < OUTPUT >
87      ;
88      0006      HALT EQU 06 ; SUICIDE FUNCTION
89      0007      MEMORY EQU 07 ; MEMORY PAGE PROTECT OR ENABLE
90      ;
91      ; *****
92      ;
93      ; Q = UT4 (BLT.2)
94      ; INTERRUPT PULSE
95      ; MEM. PROTECT
96      ;
97      ; EP1 =
98      ; EP2 =
99      ; EP3 =
100     ; EP4 =
101     ;
102     ;***** DEFINITIONS *****
103     ;
104     ;*** SAIL PROM LOCATIONS - 2716'S ***
105     ;
106     0000      BTU EQU 00H      ;*** BTU MONITOR PROM BASE PAGE ***
107     0008      PROM1 EQU 08H      ;*** TARGET PROGRAM BASE PAGE ***
108     ;
109     ;***** PAGE REFERENCES *****
110     ;
111     0056      GLOPG EQU 056H      ;*** BTU2 GLOBAL PAGE ***
112     0057      STRPG EQU 057H      ;*** BTU STACK BASE PAGE ***

```

```
113 ;  
114 ;  
115 : SEA DUCT GLOBAL PAGE = 5000  
116 : SEA DUCT STACK PAGE = 5300  
117 : SEA DUCT SEQUENCER STACK PAGE = 5200  
118 ;  
119 ; BLT.2 MONITOR STACK PAGE = 5700  
120 ; STACK END = 57FF  
121 ;  
122 ;  
123 ;*** OTHER REFERENCES ***  
124 ;  
125 57DF      STKEND EQU (STKPG * 100H) + 0DFH      ;*** STACK END = STKPG+DF  
126 ;  
127 ;  
128 ;*** SAIL FLAGS, ETC. ***  
129 ;  
130 5600      GP EQU (GLOPG * 100H)  
131 ;  
132 5602      PLEVEL EQU (GP + 02H) ; PASS THRU LEVEL  
133 5603      SYSPLG EQU (GP + 03H) ; <ADDR:WRITE:SYS: :: :: : : :>  
134 5605      CRCRAM EQU (GP + 05H) ; CRC CALC. SCRATCH  
135 5606      CRCHI EQU (GP + 06H) ; CRC HI BYTE RESULT  
136 5607      CRCLO EQU (GP + 07H) ; CRC LO BYTE RESULT  
137 5608      RBHI EQU (GP + 08H) ; RB.1 SAVE FROM LAST INTERRUPT  
138 5609      RBLO EQU (GP + 09H) ; RB.0 SAVE FROM LAST INTERRUPT  
139 560A      GRPSAV EQU (GP + 0AH) ; CURRENT I/O GROUP (OUTSIDE INTERRUPT)  
140 ;  
141 56FE      IOLOC EQU (GP + 0FEH) ; I/O BYTE  
142 ;  
143 0003      ETX EQU 03H ; ASCII ETX = 03  
144 00FF      DONE EQU 0FFH ; USED BY TTY CALLS  
145 ;  
146 081F      TARADR EQU 081FH ; TARGET SYSTEM ADDRESS - USED BY .R  
147 ;  
148 003B      PMTCHR EQU ';' ; PROMPT CHARACTER = :  
149 ; 2 BIT DLY ROUTINE  
150 ; SAIL ADDRESS AND REPLY  
151 ; DLY 250 ( 250 USEC DLY)  
152 ; DLY 20 ( INITIAL SETUP DLY)  
153 ;  
154 ;*****  
155 ;  
156 ;***** PROGRAM BEGINS HERE *****  
157 ;  
158 ;  
159 0000'      HDSTRT: ORG (BTU * 100H)  
160 0000' 71      DIS  
161 0001' 00      DB 00 ; DISABLE INTERRUPTS  
162 0002' 30 07'      BR SETSL  
163 0004' ?FFF      DW 0FFFFH  
164 0006' FF      DB 0FFH  
165 0007' 90      SETSL: GHI R0  
166 0008' B3      PHI PC ; SET PC TO STARTING ADDRESS  
167 0009' F8 0E'      LDI LOW(START1)  
168 000B' A3      PLO PC
```

169 000C' 30 56' BR SCRTST ; BRANCH TO SCRT SET UP
170 ;
171 000E' F8 01 START1: LDI 01
172 0010' A3 PLO RB
173 0011' F8 00 LDI 00
174 0013' AE PLO RE
175 0014' F8 FF LDI OFFH
176 0016' AC PLO RC
177 ;
178 0017' 33 MENAB: SEX PC ;SELECT SYSTEM I/O GROUP
179 0018' 61 OUT GROUP
180 0019' 07 DB SYSTEM
181 ;
182 001A' E8
183 001B' 8C NEWPG: GLO RC
184 001C' 32 3A' BZ FINIS
185 001E' 9E GHI RE ;ALWAYS ENABLE:
186 001F' FB 57 XRI STKPG ; STACKPAGE
187 0021' 32 2D' BZ SETQ1
188 0023' 9E GHI RE
189 0024' FB 56 XRI GLOPG ; GLOBAL PAGE
190 0026' 32 2D' BZ SETQ1
191 0028' 8B GLO RB
192 0029' 3A 2D' BNZ SETQ1 ;PROTECT OR ENABLE ?
193 002B' 7A REQ ; PROTECT -> Q = 0
194 002C' 38 SKP
195 002D' 7B SETQ1: SEQ ; ENABLE -> Q = 1
196 002E' 67 OUT MEMORY ;I/O = MEM. PROTECT
197 002F' 7A REQ
198 0030' 9E GHI RE
199 0031' FC 01 ADI 01
200 0033' BE PHI RE
201 0034' 8C GLO RC
202 0035' FF 01 SMI 01
203 0037' AC PLO RC
204 0038' 30 1B' BR NEWPG
205 ;
206 003A' E3 FINIS: SEX PC
207 003B' 61 OUT GROUP
208 003C' 36 DB UARTS
209 ;
210 ;
211 003D' F8 56 SETUP: LDI GLOPG ; GLOBAL PAGE SETUP
212 003F' 37 PHI CPAGE ; SETS R7.1 TO GLOPG
213 ;
214 ;
215 ; NO MEMORY IS CLEARED IN CASE WE WOULD LIKE TO SEE WHAT FORCED
216 ; US TO RESET THE SYSTEM
217 ;
218 ;
219 ;
220 ; *** THIS SPACE MAY BE USED FOR FURTHER SETUP ROUTINES ***
221 ;
222 ;
223 ;
224 0040' F8 20 DLY00: LDI 20H

225 0042' B8 PHI RE ; 20 = ARBITRARY DELAY WHICH
226 0043' 2E WAIT: DEC RE ; INSURES UART WILL RESET
227 0044' 98 GHI RE
228 0045' 3A 43' BNZ WAIT
229 ;
230 ;
231 0047' F8 0A SETURT: LDI LOW GRPSAV ; SELECT UART I/O GROUP
232 0049' A7 PLO GPAGE ; AND STORE ON GLOBAL PAGE
233 004A' F8 06 LDI LOW UARTS
234 004C' 57 STR GPAGE
235 004D' E7 SEX GPAGE
236 004E' 61 OUT GROUP
237 004F' E3 SEX PC
238 0050' 63 OUT CTRL1 ; SET UART1 AS SHOWN IN THE I/O GROUP
239 0051' 12 DB FORMT1 ; ALLOCATION SETUP
240 ;
241 0052' E3 SEX PC
242 0053' C0 0084' LBR UNADDR ; GO TO UNADDRESS
243 ;
244 ;
245 ;***** STANDARD CALL AND RETURN *****
246 ;
247 ;***** STANDARD CALL AND RETURN *****
248 ;
249 0056' 90 SCRTST: GHI R0 ; GET PROM #1 BASE PAGE
250 0057' B4 SCRT: PHI R4
251 0058' B5 PHI R5 ; AND PUT IN R4.1 & R5.1
252 0059' F8 57 LDI LOW STKPG
253 005B' B2 PHI STACK ; PUT STACK LOCATION IN R2
254 005C' F8 DF LDI LOW STKEND
255 005E' A2 PLO STACK
256 005F' F8 66' LDI LOW CALL
257 0061' A4 PLO R4 ; SET UP SCAL RTN PTR
258 0062' F8 76' LDI LOW(RTN)
259 0064' A5 PLO R5 ; AND RETURN
260 ;
261 ; *** STANDARD CALL ***
262 ;
263 0065' D3 CTOP: SEP PC
264 0066' E2 CALL: SEX STACK
265 0067' 36 GLO RTNPTR
266 0068' 73 STXD
267 0069' 96 GHI RTNPTR
268 006A' 73 STXD
269 006B' 93 GHI PC
270 006C' B6 PHI RTNPTR
271 006D' 83 GLO PC
272 006E' A6 PLO RTNPTR
273 006F' 46 LDA RTNPTR
274 0070' B3 PHI PC
275 0071' 46 LDA RTNPTR
276 0072' A3 PLO PC
277 0073' 30 65' BR CTOP
278 ;
279 ; *** STANDARD RETURN ***
280 ;

MACRO-18 3.36
BTU SAIL MONITOR

PAGE 1-5
20 FEB 1986 BTU2.MAC

281 0075' 03 RTOP: SEP PC ; SET P = PROGRAM COUNTER
282 0076' 96 RTN: GHI RTNPTR
283 0077' 33 PHI PC ; RETURN ROUTINE
284 0078' 86 GLO RTNPTR
285 0079' A3 PLO PC
286 007A' E2 SEX STACK
287 007B' 12 INC STACK
288 007C' 72 LDXA
289 007D' 86 PHI RTNPTR
290 007E' F0 LDX
291 007F' A6 PLO RTNPTR
292 0080' 30 75' BR RTOP
293 ;
294 ;***** I / O ERROR RECOVER *****
295 ;
296 ;
297 ;
298 0082' 32 35' IOERR: BZ READR
299 ;
300 ;
301 0084' C4 UNADDR: NOP
302 0085' F8 03 READR: LDI LOW SYSFLG ; FORCE OPEN SYSTEM
303 0087' A7 PLO GPAGE
304 0088' F8 E0 LDI 0EOH
305 008A' 57 STR GPAGE
306 ;
307 008B' F8 DF LDI LOW STKEND
308 008D' A2 PLC STACK ; RESET STACK
309 ;
310 ;***** PROMPT *****
311 ;
312 ;
313 008E' PROMPT: CALL TSRE? ;(TRANS. SER. REG. EMPTY)
314 008E' D4 +
315 008F' 023A' +
316 ;CALL TTY ;TYPE:
317 0091' D4 +
318 0092' 019D' +
319 0094' CA DB 0CAH
320 0095' 33 DB PMTCHR
321 0096' 03 DB 0014
322 0097' FF DB OFFH ; CR, LF, NULL X6,
323 ;CALL TSRE? ; PROMPT CHAR., ETX
324 0098' D4 +
325 0099' 023A' +
326 0099' C0 009E' LBR BR1ST ; GO TO FIRST BRANCH
327 ;
328 ;
329 ;***** FIRST BRANCH *****
330 ;
331 ;
332 009E' BR1ST: CALL ITB ; TEST FOR: ; ADD OR DELETE
333 009E' D4 -
334 009F' 0180' +
335 00A1' 3F DB '?' ; ? GROUP ; AS NECESSARY
336 00A2' 00C7' DW QUESGR ; FOR YOUR SYSTEM

MACRO-18	3.36	PAGE	1-6	
BTU SAIL MONITOR		20 FEB 1986	BTU2.MAC	
337	00A4'	21	DB '1'	; 1 GROUP
338	00A5'	00D4'	DW BANGGR	
339	00A7'	24	DB 'S'	; S GROUP
340	00A8'	0427'	DW TESTS	
341	00AA'	48	DB 'H'	; HELP FILE
342	00AB'	04E0'	DW HELP	
343	00AD'	4D	DB 'M'	; MEMORY PROTECT
344	00AE'	0598'	DW MEMSAV	
345	00B0'	2E	DB '.'	; DOT COMMAND EXTENSION
346	00B1'	00B7'	DW DOTGR	
347	00B3'	FF	DB OFFH	;DONE ; EXPANSION CAN BE
348	00B4'	C0 008E'	LBR PROMPT	; ADDED HERE

351 :***** DOT GROUP *****

352			;
353	00B7'		DOTGR: CALL ITB
354	00B7'	D4	+
355	00B8'	0180'	+
356	00B8'	4D	DB 'M'
357	00B9'	0336'	DW MOVE
358	00BD'	56	DB 'V'
359	00BB'	037B'	DW VERIFY
360	00C0'	52	DB 'R'
361	00C1'	0642'	DW RAMTS
362	00C3'	FF	DB OFFH
363	00C4'	C0 008E'	LBR PROMT

```
364 ;  
365 ;  
366 ;***** ? GROUP *****  
367 ;  
368 ;  
369 00C7' QUESGR: CALL ITB ; LOOK FOR:  
370 00C7' D4  
371 00C3' 0180'  
372 ; ADD OR DELETE  
373 00CA' 4D DB 'M' ; AS NECESSARY  
374 00CB' 025D' DW QUESTM ; ? M  
375 00CD' 43 DB 'C'  
376 00CE' 0453' DW CRC ; ? CRC  
377 00D0' FF DB OFFH ; DONE ; EXPANSION CAN BE  
378 00D1' C0 008E' LBR PROMPT ; ADDED HERE
```

379 :
380 :
381 :

```
381 ;***** : GROUP
382
383
384 00D4' BANGR: CALL ITB ; LOOK FOR:
385 00D4' D4 +
386 00D5' 0180' +
387 00D7' 4D DB 'M'
388 00D8' 02B7' DW WRITEM ; ! MEMORY
389 00DA' 52 DB 'R'
390 00DB' 03F5' DW RUN ; ! Run targ
391 00DD' FF DB OFFH ; DONE
392 00DE' C0 008E' LBR PROMPT
```

393 ;
394 ;
395 ;***** SAIL IN CHARACTER *****
396 ;
397 00E1' 6B INCHAR: INP STAT1
398 00E2' F6 SHR ; CHECK FOR DA (DATA AVAILABLE)
399 00E3' 3B E1' BNF INCHAR ; IF NOT TRY CLRBIT
400 00E5' FA 06 ANI 06H ; MASK FOR:
401 00E7' 32 ED' BZ KEEP2 ; FRAME AND PARITY ERROR
402 00E9' 6A INP DATA1 ; CLEAR BAD DATA
403 ;
404 ;*****
405 00EA' C0 0082' LBR IOERR ;***** USUALLY "BR INCHAR"
406 ; BR INCHAR ; IS USED HERE *****
407 ;*****
408 ;
409 00ED' F8 FE KEEP2: LDI LOW IOLOC ; PUT GOOD DATA AT GP = I/O LOCATION
410 00EF' A7 PLO GPAGE
411 00F0' E7 SEX GPAGE
412 00F1' 6A INP DATA1
413 00F2' FA 7F ANI 07FH ; CLEAR MSB
414 00F4' 57 STR GPAGE ; STORE AT GP I/O LOCATION
415 00F5' FB 23 XRI '#' ; IS IT '#' ?
416 00F7' C2 0082' LBZ IOERR
417 00FA' C0 0150' LBR DELAY2 ; 2 BIT DELAY
418 ;
419 ;
420 ;***** INPUT 4 DIGITS TO R(D) - (IN4D) *****
421 ;
422 00FD' F8 00 IN4D: LDI LOW 00
423 00FF' BD PHI RD ; SET R(D) = 0000
424 0100' AD PLO RD
425 0101' IN4D2: CALL INCHAR
426 0101' D4 -
427 0102' 00E1' +
428 0104' 07 LDN GPAGE
429 0105' FB 0D XRI 0DH ; INCHAR XOR CR IS IT 'CR' ?
430 0107' 32 0D' BZ IN4RET ; GP -> I/O LOC.
431 0109' FB 2D XRI 2DH ; "SPACE" XOR CR IS IT ' ' ?
432 010B' 3A 0E' BNZ CNVRT
433 010D' IN4RET: EXIT
434 010D' D5 +
435 ;
436 ;
437 010E' CNVRT: CALL ASCHEX
438 010E' D4 -
439 010F' 0118' +
440 0111' 33 01' BDF IN4D2
441 CALL SHFTD4
442 0113' D4 +
443 0114' 013A' +
444 0116' 30 01' BR IN4D2
445 ;
446 ;
447 0118' 07 ASCHEX: LDN GPAGE
448 0119' FC 00 ADI 0D0H ; CALLED BY CNVRT AND : MEMORY

MACRO-18 3.36
BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

449 011B' 3B 37' BNF NOTHEX
450 011D' 07 LDN GPAGE
451 011E' FD 39 SDI 039H
452 0120' 33 30' BDF NUMBER
453 0122' 07 LDN GPAGE
454 0123' FC BF ADI 0BFH
455 0125' 3B 37' BNF NOTHEX
456 0127' 07 LDN GPAGE
457 0128' FD 46 SDI 046H
458 012A' 3B 37' BNF NOTHEX
459 012C' 07 LDN GPAGE
460 012D' FC C9 ADI 0C9H
461 012F' 38 SKP
462 0130' 07 NUMBER: LDN GPAGE
463 0131' FA 0F ANI 00FH
464 0133' 57 STR GPAGE
465 0134' FC 00 ADI 000H ; CLEAR DF
466 EXIT
467 0136' D5 +
468 0137' FF 00 NOTHEX: SMI 000H ; SET DF
469 EXIT
470 0139' D5 +
471 ;
472 ;
473 013A' 8C SHFTD4: GLO RC
474 013B' 52 STR STACK
475 013C' F8 04 LDI LOW 04H
476 013E' AC PLO RC
477 013F' 8D SHIFT: GLO RD
478 0140' FE SHL
479 0141' AD PLO RD
480 0142' 9D GHI RD
481 0143' 7E SHLC
482 0144' BD PHI RD
483 0145' 2C DEC RC
484 0146' 8C GLO RC
485 0147' JA 0F' BNZ SHIFT
486 0149' 02 LDN R2
487 014A' AC PLO RC
488 014B' E7 SEX GPAGE
489 014C' 8D GLO RD
490 014D' F1 OR
491 014E' AD PLO RD
492 EXIT
493 014F' D5 +
494 ;
495 ;
496 ;*****2 BIT DELAY*****
497 ;
498 ; INSTRUMENT SPECIFIC:
499 0150' F8 80 DELAY2: LDI LOW 80H ; 80H = 10.8 mSec FOR
500 0152' FF 01 WAIT3: SNI 01H ; 1.3288 MHZ SYSTEM CPU CLOCK
501 0154' C4 NOP
502 0155' C4 NOP
503 0156' C4 NOP
504 0157' JA 52' BNZ WAIT3

MACRO-18 3.36 PAGE 1-9
 BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

```

 505 0159' FC 00           ADI 00H      ; CLEAR DF
 506                               EXIT
 507 015B' D5               +
 508                               ;
 509                               ;
 510                               ; ***** IN KEY WORD *****
 511                               ;
 512 015C'                   INKWD: CALL INCHAR
 513 015C' D4               +
 514 015D' 00E1'            +
 515 015F' CB 016B'          LBNF TMATCH
 516 0162' 46               PLIST: LDA LIST
 517 0163' FB FF             XRI OFFH      ; IS IT FF ?
 518 0165' CA 0162'          LBNZ PLIST
 519 0168' 16               INC LIST
 520 0169' 16               INC LIST
 521                               EXIT      ; GOES TO LBR AT END OF LIST
 522 016A' D5               +
 523                               ;
 524 016B' 07               TMATCH: LDN GPAGE ; GPAGE = I/O LOC.
 525 016C' E6               SEX RTNPTR
 526 016D' F3               XOR          ; I/OLOC = LIST ?
 527 016E' CA 0162'          LBNZ PLIST
 528 0171' 16               MATCH: INC LIST
 529 0172' 06               LDN LIST
 530 0173' FB FF             XRI OFFH
 531 0175' CA 015C'          LBNZ INKWD
 532 0178' 16               INC LIST
 533 0179' 46               LDA RTNPTR
 534 017A' 52               STR STACK
 535 017B' 46               LDA RTNPTR
 536 017C' A6               PLO RTNPTR
 537 017D' 02               LDN STACK
 538 017E' 56               PHI RTNPTR
 539                               EXIT      ; GOES RETURN INDICATED AT LIST END
 540 017F' D5               -
 541                               ;
 542                               ;
 543                               ; ***** INPUT TEST AND BRANCH *****
 544                               ;
 545                               ;
 546 0180'                   ITB: CALL INCHAR
 547 0180' D4               +
 548 0181' 00E1'            +
 549 0183' E7               SEX GPAGE
 550 0184' 46               NEXT2: LDA LIST
 551 0185' FB FF             XRI OFFH      ; IS LIST FF ?
 552 0187' CA 018B'          LBNZ TEST
 553                               EXIT
 554 018A' D5               +
 555                               ;
 556 018B' FB FF             TEST: XRI OFFH
 557 018D' F3               XOR
 558 018E' C2 0196'          LBNZ MATCH2 ; DOES CHAR = LIST ?
 559 0191' 16               INC LIST
 560 0192' 16               INC LIST
  
```

MACRO-18 3.36
BTU SAIL MONITOR PAGE 1-10
20 FEB 1986 BTU2.MAC

561 0193' C0 0184' LBR NEXT2
562 0196' 46 MATCH2: LDA RTN PTR ;
563 0197' 52 STR STACK
564 0198' 46 LDA RTN PTR
565 0199' A6 PLO RTN PTR
566 019A' 02 LDN STACK
567 019B' B6 PHI RTN PTR
568 EXIT
569 019C' D5 +
570 ;
571 ;
572 ;***** TTY *****
573 ;
574 ;
575 019D' F8 FE TTY: LDI LOW IOLOC
576 019F' A7 PLO GPAGE ;TTY CHECKS FOR THE FOLLOWING PSUEDO OPS IN LIST:
577 01A0' 46 NEXT3: LDA RTN PTR ;*****
578 01A1' FB FF XRI OFFH ;IS IT FF? ; ASCII CHAR -> TYPES IT
579 01A3' 3A A8' BNZ TEST80 ; 30 = ASCII @ RD.1
580 01A5' FC 00 ADI 00H ;CLEAR DF ; 31 = HEX PAIR @ RD.1
581 EXIT ; 2nd CALL SENDS HXPR @ RD.0
582 01A7' D5 +
583 01A8' FB 7F TEST80: XRI 07FH ;80 XOR FF ; 3D = HEX PAIR @ M(RD), INC RD
584 01AA' 3A B5' BNZ TEST81 ;IS IT 80? ; CA = TYPES CR, LF
585 01AC' 9D ASCRD1: GHI RD ; 9D = CALLS IN4D
586 01AD' 57 STR GPAGE ; DD = DECIMAL @ M(RD) (00-99)
587 01AE' 8D GLO RD ; A1 = SEND HI HEX NIBBLE @ M(RD)
588 01AF' BD PHI RD ; A2 = SEND LO HEX NIBBLE @ M(RD), INC RD
589 01B0' OUTPT2: CALL OUTCHR ; FF = DONE (END OF LIST)
590 01B0' D4 +
591 01B1' 0249' +
592 01B3' 30 A0' BR NEXT3 ;*****
593 ;
594 01B5' FB 01 TEST81: XRI (31H XOR 30H) ;31 XOR 30
595 01B7' CA 01D4' LBNZ TEST8D ;IS IT 81?
596 01BA' 9D HEXRD1: GHI RD
597 01BB' E2 SEX STACK
598 01BC' 73 STXD
599 01BD' 8D GLO RD
600 01BE' BD PHI RD
601 01BF' 12 OUTHEX: INC STACK
602 01C0' 02 LDN STACK
603 01C1' 22 DEC STACK
604 01C2' F6 SHR
605 01C3' F6 SHR
606 01C4' F6 SHR
607 01C5' F6 SHR
608 01C6' 57 STR GPAGE
609 CALL HXCONV
610 01C7' D4 +
611 01C8' 0222' +
612 01CA' 12 INC STACK
613 01CB' 02 LDN STACK
614 01CC' FA 0F ANI OPF
615 01CE' 57 STR GPAGE
616 CALL HXCONV

MACRO-18 3.36
BTU SAIL MONITOR PAGE 1-11
20 FEB 1986 BTU2.MAC

617 01CF' D4 +
618 01D0' 0222' +
619 01D2' 30 A0' ;BR NEXT3
620 ;
621 01D4' FB 0C TEST8D: XRI (8DH XOR 81H) ;8D XOR 81
622 01D6' 3A 0D' BNZ TESTCA ;IS IT 8D ?
623 01D8' 4D LDA RD
624 01D9' E2 SEX STACK
625 01DA' 73 STXD
626 01DB' 30 BF' BR OUTHEX
627 ;
628 01DD' FB 47 TESTCA: XRI (0CAH XOR 8DH) ;CA XOR 8D
629 01DF' 3A E9' BNZ TEST9D ;IS IT CA ?
630 01E1' OUTCA: CALL TTY
631 01E1' D4 +
632 01E2' 019D' +
633 01E4' 0D0A DW 0D0AH ;CR,LF
634 01E6' FF DB DONE ;DONE
635 01E7' 30 A0' BR NEXT3
636 ;
637 01E9' FB 57 TEST9D: XRI (9DH XOR 0CAH) ;9D XOR CA
638 01EB' 3A F2' BNZ TESTDD ;IS IT 9D ?
639 CALL IN4DT? ; ONLY CALL OF IN4DT?
640 01ED' D4 +
641 01EE' 0234' +
642 01F0' 30 A0' ;BR NEXT3
643 ;
644 01F2' FB 40 TESTDD: XRI (0DDH XOR 9DH) ;DD XOR 9D IS IT DD ?
645 01F4' CA 01FD' LBNZ TESTA1
646 01F7' 4D LDA RD
647 01F8' F9 30 ORI 030H
648 01FA' C0 021E' LBR OUTPT1
649 ;
650 01FD' FB 3C TESTA1: XRI (0A1H XOR 09DH) ;IS IT A1?
651 01FF' CA 020E' LBNZ TESTA2
652 0202' 0D LDN RD
653 0203' F6 SHR
654 0204' F6 SHR
655 0205' F6 SHR
656 0206' F6 SHR
657 0207' 57 STR GPAGE
658 CALL HXCONV
659 0208' D4 +
660 0209' 0222' +
661 020B' C0 01A0' ;LBR NEXT3
662 ;
663 020E' FB 03 TESTA2: XRI (0A2H XOR 0A1H) ;IS IT A2?
664 0210' 3A 1C' BNZ OUTASC ;EXTEND TTY W/ BRANCH FROM HERE
665 0212' 4D LDA RD
666 0213' FA 0F ANI 0FH
667 0215' 57 STR GPAGE
668 CALL HXCONV
669 0216' D4 +
670 0217' 0222' +
671 0219' C0 01A0' ;LBR NEXT3
672 ;

MACRO-18 3.36
BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

673 021C' 26 OUTASC: DEC RTN PTR
674 021D' 46 LDA RTN PTR
675 021E' 57 OUTPT1: STR GPAGE
676 021F' C0 0130' LBR OUTPT2
677 ;
678 ;
679 0222' 07 EXCONV: LDN GPAGE ; ONLY USED BY TTY
680 0223' FC F6 ADI OF6H
681 0225' C3 0230' LBDF GTR9
682 0228' 07 LDN GPAGE
683 0229' F9 30 ORI 030H
684 022B' 57 STORE: STR GPAGE
685 CALL OUTCHR
686 022C' D4 +
687 022D' 0249' +
688 EXIT
689 022F' D5 +
690 ;
691 0230' FC 41 GTR9: ADI 041H
692 0232' 30 2B' BR STORE
693 ;
694 ;
695 ***** IN4D TSRE *****
696 ;
697 ;
698 0234' IN4DT?: CALL TSRE?
699 0234' D4 +
700 0235' 023A' +
701 0237' C0 00FD' LBR IN4D
702 ;
703 ;***** WAIT FOR TRANS. SER. REG. EMPTY *****
704 ; (LOOP 1)
705 ;
706 ; CALLED BY PROMPT, TEST OK.
707 023A' E2 TSRE?: SEX STACK ; AND IN4TSRE, AND PASSTHRU
708 023B' 6A WAIT4: INP DATA1 ; CLEAR DA (DATA AVAILABLE)
709 023C' 6B INP STAT1
710 023D' FA C0 ANI OCOH ; MASK FOR TSRE & THRE
711 023F' FB C0 XRI OCOH ; TSRE = THRE = 1 ?
712 0241' 3A 3B' BNZ WAIT4
713 CALL DELAY2 ; 2 BIT DLY
714 0243' D4 +
715 0244' 0150' +
716 0246' E2 SEX STACK
717 0247' 6A INP DATA1 ; CLEAR ECHO DA
718 EXIT
719 0248' D5 +
720 ;
721 ;
722 ;***** SAIL OUT CHARACTER *****
723 ; (LOOP 1)
724 ;
725 0249' 6B OUTCHR: INP STAT1
726 024A' FA OC ANI OCH ; CHECK PREVIOUS I/O ERROR
727 024C' CA 0082' LBNZ IOERR
728 024F' 02 THRE?: LDN STACK

MACRO-18 3.36
BTU SAIL MONITOR

PAGE 1-13
20 FEB 1986 BTU2.MAC

729 0250' FE SHL ; CHECK THRE
730 0251' CB 0249' LBNF OUTCHR ; WAIT FOR UART READY
731 0254' E7 SEX GPAGE
732 0255' F8 FE LDI LOW IOLOC
733 0257' A7 PLO GPAGE
734 0258' 62 OUT DATA1 ; LOAD UART FROM I/O LOCATION
735 0259' 27 DEC GPAGE
736 025A' FC 00 ADI 00H ; CLEAR DF
737 EXIT
738 025C' D5 +
739 ;
740 ;
741 ;***** ? Memory routine *****
742 ;
743 ;
744 025D' QUESTM: CALL IN4D
745 025D' D4 +
746 025E' 00FD' +
747 0260' E2 SEX STACK
748 0261' 8D GLO RD
749 0262' 73 STXD
750 0263' 9D GHI RD
751 0264' 73 STXD
752 CALL IN4D
753 0265' D4 +
754 0266' 00FD' +
755 0268' 9D GHI RD
756 0269' 3E PHI RE
757 026A' 3D GLO RD
758 026B' AE PLO RE
759 026C' 12 INC STACK
760 026D' 42 LDA STACK
761 026E' 3D PHI RD
762 026F' 02 LDN STACK
763 0270' AD PLO RD
764 CALL DELAY2
765 0271' D4 +
766 0272' 0150' +
767 0274' E2 OUTADR: SEX STACK
768 0275' 8D GLO RD
769 0276' 73 STXD
770 0277' 9D GHI RD
771 0278' 73 STXD
772 CALL TTY
773 0279' D4 +
774 027A' 019D' +
775 027C' CA DB 0CAH
776 027D' 81 DB 081H ; TYPE: CR, LF, NULL X 6, R
777 027E' 81 DB 081H
778 027F' 20 DB 020H ; OUT HEX PR X2, SPACE
779 0280' FF DB 0FFH ; DONE
780 0281' 12 INC STACK
781 0282' 42 LDA STACK
782 0283' BD PHI RD
783 0284' 02 LDN STACK
784 0285' AD PLO RD

MACRO-18 3.36
BTU SAIL MONITOR

PAGE 1-14
20 FEB 1986 BTU2.MAC

785 0286' 8E NEXBYT: GLO RE
786 0287' 3A 8D' BNZ DECCNT
787 0289' 9E GHI RE
788 028A' C2 008E' LBZ PROMPT
789 028D' 2E DECCNT: DEC RE
790 2E CALL TTY
791 028E' D4
792 028F' 019D' +
793 0291' 8DFF DW 8DFFH ; TYPE: OUT HEX RD, DONE
794 0293' 8D GLO RD
795 0294' FA 0F ANI 00FH ; MASK FOR LINE LENGTH
796 0296' C2 02A6' LBZ LNTEST ; 07 = 08H / LINE
797 0299' FA 01 ANI 01H ; 0F = 10H / LINE
798 029B' CA 0286' LBNZ NEXBYT
799 CALL TTY
800 029E' D4 +
801 029F' 019D' +
802 02A1' 20FF DW 20FFH ; TYPE: SPACE, DONE
803 02A3' C0 0286' LBR NEXBYT
804 02A6' 8E LNTEST: GLO RE ; TEST FOR END OF LINE
805 02A7' 3A AF' BNZ LNEND
806 02A9' 9E GHI RE
807 02AA' 3A AF' BNZ LNEND
808 02AC' C0 008E' LBR PROMPT
809 02AF' LNEND: CALL TTY ; TYPE: ' ', DONE
810 02AF' D4 +
811 02B0' 019D' +
812 02B2' 3BFF DW 3BFFH
813 02B4' C0 0274' LBR OUTADR
814 ;
815 ;
816 ;***** ! Memory Routine *****
817 ;
818 ;
819 02B7' F8 03 WRITEM: LD1 LOW SYSFLG
820 02B9' A7 PLO GPAGE
821 02BA' 07 LDN GPAGE ; CHECK FOR UNLOCK FLAG
822 02BB' FA 40 ANI 40H ; 30 TO SAY NO IF LOCKED
823 02BD' C2 03F8' LBZ SAYNO
824 02C0' INADDR: RLDI RD, 0000 ; WAIT FOR NUMERIC INPUT
825 02C0' 68 CD +
826 02C2' 0000 +
827 CALL INCHAR
828 02C4' D4 +
829 02C5' 00E1' +
830 CALL ASCHEX
831 02C7' D4 +
832 02C8' 0118' +
833 02CA' 33 C0' BDF INADDR
834 CALL SHFTD4 ; PUT ADDRESS POINTER IN R(8)
835 02CC' D4 +
836 02CD' 013A' +
837 CALL IN4D2
838 02CF' D4 +
839 02D0' 0101' +
840 02D2' 9D GHI RD

MACRO-18 3.36
BTU SAIL MONITOR

PAGE 1-15
20 FEB 1986 BTU2.MAC

341 02D0' BE PHI RE
342 02D4' 3D GLO RD
343 02D5' AE PLO RE
344 02D6' D4 INIST: CALL INCHAR
345 02D6' D4 -
346 02D7' 00B1' -
347 02D9' 07 LDN GPAGE
348 02DA' 02 06' BZ INIST : IGNORE NULLS (NULL =0)
349 CALL ASCHEX
350 02DC' D4 +
351 02DD' 0118' +
352 02DF' 03 FF' BDF TESTSP : DF = NOT HEX
353 02E1' 07 LDN GPAGE
354 02E2' AD PLO RD : SAVE LO DIGIT
355 02E3' IN2ND: CALL INCHAR
356 02E3' D4 +
357 02E4' 00B1' +
358 CALL ASCHEX
359 02E6' D4 +
360 02E7' 0118' +
361 02E9' 03 F0' BDF ERROR
362 CALL SHFTD4
363 02E9' D4 +
364 02EC' 013A' -
365 02EE' 3D GLO RD
366 02EF' 63 STR RE : WRITE INTO RAM
367 02F0' 1E INC RE
368 02F1' 00 06' BR INIST
369 ;
370 02F3' ERROR: CALL DELAY2
371 02F3' D4 -
372 02F4' 0160' -
373 CALL PTY : TYPE:
374 02F6' D4 -
375 02F7' 0190' -
376 02F9' 00007 DW SPASH : ? ? ?
377 02F9' FF DB DONE : DONE
378 02FC' 00 0008' LBR PROMPT
379 ;
380 02FF' 07 TESTSP: LDN GPAGE : TEST FOR DELIMITORS
381 0300' FB 00 KRI 00H : XOR 'SPACE' IS IT 'SPACE'?
382 0302' 03 02D6' LBR INIST
383 0305' FB 00 KRI 00H : XOR 'SPACE' IS IT 'SPACE'?
384 0307' CA 0010' LBNZ SEMI?
385 CALL PASSCA
386 030A' D4 +
387 030B' 0024' -
388 030D' 00 02D6' LBR INIST
389 0310' FB 17 SEMI?: KRI 01FH : XOR '!' IS IT '!'?
390 0312' 3A 1A' BNZ TESTOR
391 CALL PASSCA
392 0314' D4 -
393 0315' 0024' -
394 0317' 00 02C0' LBR INADDR
395 031A' FB 36 TESTOR: KRI 036H : 'CR' XOR '!' IS IT 'CR'?
396 031C' CA 02F3' BNZ ERROR

MACRO-18 3.36 PAGE 1-16
 BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

```

 897  031F' FC 00          ADI 00H      ; IF NO ERROR, CLEAR DF
 898  0321' C0 008E'       LBR PROMPT   ; GO TO PROMPT
 899
 900  0324'               ; PASSCA: CALL INCHAR ; ONLY USED BY IM
 901  0324' D4             +
 902  0325' 00E1'          +
 903  0327' 07             LDN GPAGE
 904  0328' FB 0D          XRI 0DH      ; IS IT 'CR' ?
 905  032A' CA 0324'       LBNZ PASSCA
 906  032D'               INLF: CALL INCHAR
 907  032D' D4             +
 908  032E' 00E1'          +
 909  0330' 07             LDN GPAGE
 910  0331' FB 0A          XRI 0AH      ; IS IT 'LF' ?
 911  0333' 0A 2D'         BNZ INLF
 912
 913  0335' D5             +
 914
 915
 916
 917
 918  0336'               MOVE: CALL TTY
 919  0336' D4             +
 920  0337' 019D'          +
 921  0339' 6F 76 65 20    DB 'ove from '
 922  033D' 66 72 67 5D
 923  0341' 20
 924  0342' 03             DB ETX
 925  0343' 9DFF           DW 09DFFH
 926  0345' 9D             GHI RD
 927  0346' 3A             PHI RA
 928  0347' 3D             GLO RD
 929  0348' AA             PLO RA
 930
 931  0349' D4             +
 932  034A' 019D'          -
 933  034C' 74 6F 20        DB o '
 934  034F' 03             DB ETX
 935  0350' 9DFF           DW 09DFFH
 936  0352' 9D             GHI RD
 937  0353' 36             PHI RB
 938  0354' 3D             GLO RD
 939  0355' A3             PLO RB
 940
 941  0356' D4             +
 942  0357' 019D'          -
 943  0359' 6C 65 6E 67    DB 'length '
 944  035D' 74 68 20
 945  0360' 03             DB ETX
 946  0361' 9DFF           DW 09DFFH
 947
 948  0363' D4             -
 949  0364' 0407'          -
 950  0366' CB 008E'       CBNF PROMPT ; return to prompt if no flag
 951
 952  0369' 3A             MOV: LDA RA
  
```

MACRO-18 3.36
BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

953 036A' 58 STR RB
954 036B' 13 INC RB
955 036C' 20 DEC RD
956 036D' 90 GHI RD
957 036E' 3A 69' BNZ MOV
958 0370' 3D GLO RD
959 0371' 3A 69' BNZ MOV
960 CALL TTY
961 0373' D4 +
962 0374' 019D' +
963 0376' 07FF DW 07FFH
964 0378' C0 008E' MOVRDN: LBR PROMPT
965 ;
966 ;
967 ;***** VERIFY *****
968 ;
969 ;
970 0379' VERIFY: CALL TTY
971 0379' D4 +
972 037C' 019D' +
973 037E' 65 72 69 66 DB 'erify '
974 0382' 79 20
975 0384' 03 DB ETX
976 0385' 9DFF DW 09DFFH
977 0387' 9D GHI RD ;STORE 'VERIFY' GROUP ADDR IN RA
978 0388' BA PHI RA
979 0389' 3D GLO RD
980 038A' AA PLO RA
981 CALL TTY
982 038B' D4 +
983 038C' 019D' +
984 038E' 77 69 74 63 DB 'with '
985 0392' 20
986 0393' 03 DB ETX
987 0394' 9DFF DW 09DFFH
988 0396' 9D GHI RD ;STORE 'WITH' group in R3
989 0397' 3B PHI RB
990 0398' 3D GLO RD
991 0399' A3 PLO RB
992 CALL TTY
993 039A' D4 +
994 039B' 019D' +
995 039D' 6C 65 6E 67 DB 'length '
996 03A1' 74 68 20
997 03A4' 03 DB ETX
998 03A5' 9DFF DW 09DFFH
999 03A7' 9D GHI RD ;STORE LENGTH IN RC
1000 03A8' 3C PHI RC
1001 03A9' 3D GLO RD
1002 03AA' AC PLO RC
1003 ;
1004 03AB' 9C VNEXT: GHI RC
1005 03AC' 3A 3D' BNZ VMORE
1006 03AE' 3C GLO RC
1007 03AF' 3A 3D' BNZ VMORE
1008 CALL TTY

MACRO-18 3.36 PAGE 1-18
 BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

```

1009 03B1' D4      +
1010 03B2' 019D'   +
1011 03B4' 20 44 4F 4E      DB ' DONE'
1012 03B8' 45      DB DONE
1013 03B9' FF      LBR PROMPT
1014 03BA' CO 00SE' ;
1015 ;
1016 03BD' E8      VMORE: SEX RB
1017 03BE' 0A      LDN RA
1018 03BF' F3      XOR
1019 03C0' 3A C7'  BNZ VBAD
1020 03C2' 1A      VCONT: INC RA
1021 03C3' 1B      INC RB
1022 03C4' 3C      DEC RC
1023 03C5' 30 AB'  BR VNEXT
1024 ;
1025 03C7' E2      VBAD: SEX STACK ; OUTPUT BAD LOCATIONS AND CONTENTS
1026 03C8' 9A      GHI RA
1027 03C9' 3D      PHI RD
1028 03CA' 8A      GLO RA
1029 03CB' AD      PLO RD
1030           CALL TTY
1031 03CC' D4      +
1032 03CD' 019D'   +
1033 03CF' CA81      DW 0CA81H ; REG A ADDRESS
1034 03D1' 8120      DW 08120H
1035 03D3' FF      DB OFFH
1036 03D4' 9A      GHI RA
1037 03D5' 3D      PHI RD
1038 03D6' 8A      GLO RA
1039 03D7' AD      PLO RD
1040           CALL TTY
1041 03D8' D4      +
1042 03D9' 019D'   +
1043 03DB' 3D20      DW 08D20H ; REG A CONTENTS
1044 03DD' 20FF      DW 020FFH
1045 03DF' 9B      GHI RB
1046 03E0' 3D      PHI RD
1047 03E1' 3B      GLO RB
1048 03E2' AD      PLO RD
1049           CALL TTY
1050 03E3' D4      +
1051 03E4' 019D'   +
1052 03E6' 3D20      DW 08D20H ; REG B CONTENTS
1053 03E8' FF      DB OFFH
1054 03E9' 9B      GHI RB
1055 03EA' 3D      PHI RD
1056 03EB' 3B      GLO RB
1057 03EC' AD      PLO RD
1058           CALL TTY
1059 03ED' D4      +
1060 03EE' 019D'   +
1061 03F0' 9181      DW 08181H ; REG B ADDRESS
1062 03F2' FF      DB OFFH
1063 03F3' 30 C2'  BR VCONT
1064 ;
  
```

MACRO-18 3.36
BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

1065 ;
1066 ;***** RUN TARGET SYSTEM *****
1067 ;
1068 03F5' CO 001F RUN: LBR TARADR
1069 ;
1070 ;
1071 ;
1072 ;***** SAY NO ; *****
1073 ;
1074 03F8' SAYNO: CALL DELAY2
1075 03F8' D4 +
1076 03F9' 0150' +
1077 CALL TTY
1078 03FB' D4 +
1079 0JFC' 019D' +
1080 03FE' 204E DW 204EH ; TYPE: SPACE No :
1081 0400' 6F20 DW 6F20H ; DONE
1082 0402' 21FF DW 21FFH
1083 0404' CO 008E' LBR PROMPT
1084 ;
1085 ;
1086 ;
1087 ;***** TEST OK ? *****
1088 ;
1089 3407' OK?: CALL TSRE?
1090 3407' D4 +
1091 3408' 023A' +
1092 CALL TTY ;TYPE: OK ?,
1093 340A' D4 +
1094 340B' 019D' +
1095 340D' 20 4F 68 20 DB ' Ok ? '
1096 3411' 3F 20
1097 3413' 00 DB ETX
1098 3414' FF DB DONE ; DONE
1099 ;
1100 3415' YES?: CALL TSRE?
1101 3415' D4 +
1102 3416' 023A' +
1103 CALL INCHAR
1104 3418' D4 -
1105 3419' 00E1' -
1106 3419' 07 LDN GPAGE
1107 341C' FB 59 XRI 059H ; XOR 'Y' IS IT YES ?
1108 341E' CA 3424' LBNZ NO
1109 ;
1110 3421' FF 00 ORRTN: SMI OOH ; SET DF
1111 ; EXIT
1112 3423' D5 +
1113 3424' FC 00 NO: ADI OOH ; CLEAR DF
1114 ; EXIT
1115 3426' D5 +
1116 ;
1117 ;
1118 ;
1119 ;***** S P (RUNS PROGRAM AT AAAA *****
1120 ; WITH PC = R3, X = R2)

MACRO-18 3.36
BTU SAIL MONITOR

PAGE 1-20
20 FEB 1986 BTU2.MAC

1121 ;
1122 0427' F8 03 TEST\$: LD1 LOW SYSFLG
1123 0429' A7 PLO GPAGE
1124 042A' 07 LDN GPAGE
1125 042B' FA E0 ANI 0EOH ; MASK FOR ADDR, WRITE, SYS FLAGS
1126 042D' FB E0 XRI 0EOH ; ADDR = WRITE = SYS = 1 ?
1127 042F' CA 03F8' LBNZ SAYNO
1128 0432' IN\$: CALL IN4D
1129 0432' D4 +
1130 0433' 00FD' +
1131 0435' 9D GHI RD
1132 0436' BE PHI RE
1133 0437' 8D GLO RD
1134 0438' AE PLO RE
1135 CALL TTY
1136 0439' D4 +
1137 043A' 019D' +
1138 043C' 2081 DW 2081H ; TYPE: SPACE,
1139 043E' 812C DW 812CH ; OUT HEX PR ','
1140 0440' FF DB OFFH ; DONE
1141 CALL OK?
1142 0441' D4 +
1143 0442' 0407' +
1144 0444' CB 008E' LBNF PROMPT
1145 0447' 32 SEX STACK ; X => R2
1146 0448' 36 GLO RTNPTR
1147 0449' 73 STXD
1148 044A' 96 GHI RTNPTR
1149 044B' 73 STXD
1150 044C' 9E GHI RE
1151 044D' 36 PHI RTNPTR
1152 044E' 3E GLO RE
1153 044F' A6 PLO RTNPTR
1154 0450' FC 00 ADI 00 ; CLEAR DF
1155 EXIT
1156 0452' 05 +
1157 ;
1158 ;
1159 ;
1160 ***** CRC CALCULATION *****
1161 ;
1162 ;
1163 0453' CRC: CALL TTY ;TYPE:
1164 0453' D4 +
1165 0454' 019D' +
1166 0456' 52 43 20 DB 'RC ' ; RC from,
1167 0459' 66 72 6F 6D DB 'from ' ; ETX,
1168 045D' 20
1169 045E' 33 DB 03H ; IN4D,
1170 045F' 9DFF DW 9DFFH ; DONE
1171 0461' 9D GHI RD
1172 0462' BE PHI RE
1173 0463' 8D GLO RD
1174 0464' AE PLO RE
1175 0465' CALL TTY ;TYPE:
1176 0465' D4 +

MACRO-18 3.36 PAGE 1-21
 BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

```

1177 0466' 019D'      +
1178 0468' 67 76 65 72      DB 'over' ; over,
1179 046C' 20
1180 046D' 03
1181 046E' 9D
1182 046F' FF
1183 0470' F8 07
1184 0472' A7
1185 0473' F8 00
1186 0475' 3C
1187 0476' 57
1188 0477' 27
1189 0478' 57
1190 0479' 06
1191 047A' FB FF
1192 047C' CE
1193 047D' BC
1194 047E' E2
1195
1196 047F' D4
1197 0480' 04BB' +
1198 0482' 2D
1199 0483' 8D
1200 0484' CA 0479'
1201 0487' 9D
1202 0488' CA 0479'
1203 048B' 9C
1204 048C' C2 04A3'
1205 048F' 97
1206 0490' 3D
1207 0491' 37
1208 0492' AD
1209
1210 0493' D4
1211 0494' 019D' +
1212 0496' CA
1213 0497' 43 52 43 20
1214 0498' 3D 20
1215 049D' 8D8D
1216 049F' FF
1217 04A0' CO 008E'
1218 04A3' SAYCLR: CALL TTY ; IF CLEAR, TYPE: CR, LF, NULL X6
1219 04A3' D4
1220 04A4' 019D' +
1221 04A6' CA
1222 04A7' 4D 65 6D 6F
1223 04AB' 72 79 20
1224 04AE' 69 73 23 63
1225 04B2' 6C 65 61 72
1226 04B6' 2E
1227 04B7' FF
1228 04B8' CO 008E'
1229
1230
1231 04B8' 87
1232 04BC' 4E
  
```

CRCSUB: SEX GPAGE ; CRC CALCULATION SUBROUTINE

LDA RE

MACRO-18 3.36
BTU SAIL MONITOR PAGE 20 FEB 1986 BTU2.MAC

1233	04BD'	F3	XOR
1234	04BE'	27	DEC GPAGE
1235	04BF'	57	STR GPAGE
1236	04C0'	F6	SHR
1237	04C1'	F6	SHR
1238	04C2'	F6	SHR
1239	04C3'	F6	SHR
1240	04C4'	F3	XOR
1241	04C5'	57	STR GPAGE
1242	04C6'	FE	SHL
1243	04C7'	FE	SHL
1244	04C8'	FE	SHL
1245	04C9'	FE	SHL
1246	04CA'	60	IRX
1247	04CB'	60	IRX
1248	04CC'	F3	XOR
1249	04CD'	27	DEC GPAGE
1250	04CE'	73	STXD
1251	04CF'	72	LDXA
1252	04D0'	F6	SHR
1253	04D1'	F6	SHR
1254	04D2'	F6	SHR
1255	04D3'	F3	XOR
1256	04D4'	73	STXD
1257	04D5'	F0	LDX
1258	04D6'	FE	SHL
1259	04D7'	FE	SHL
1260	04D8'	F3	SHL
1261	04D9'	FE	SHL
1262	04DA'	FE	SHL
1263	04DB'	F3	XOR
1264	04DC'	60	IRX
1265	04DD'	60	IRX
1266	04DE'	73	STXD
1267			EXIT
1268	04DF'	D5	+
1269			:
1270			:
1271			***** HELP FILE *****
1272			:
1273			:
1274	04E0'		HELP: CALL TTY
1275	04E0'	D4	+
1276	04E1'	019D'	+
1277	04E3'	65 6C 70	DB 'elp'
1278	04E6'	CA	DB OCAB
1279	04E7'	42 54 55 20	DB 'BTU MONITOR'
1280	04E8'	4D 4F 4E 49	
1281	04E9'	54 4F 52	
1282	04F2'	CACA	DB OCACAH
1283	04F4'	53 79 73 74	DB 'System Commands:'
1284	04F8'	65 6D 20 43	
1285	04F9'	6F 6D 6D 61	
1286	0500'	6E 64 73 3A	
1287	0504'	CA	DB OCAB
1288	0505'	20 24 61 61	DB '\$aaaa (Run @ aaaa)'

MACRO-18 3.36
BTU SAIL MONITOR PAGE 1-20
20 FEB 1986 BTU2.MAC

1289 0509' 61 61 20 28
1290 050D' 52 75 68 20
1291 0511' 40 20 61 61
1292 0515' 61 61 29
1293 0518' CA DB 0CAH
1294 0519' 20 21 52 75 DB ' :Run target system :'
1295 051D' 6E 20 74 61
1296 0521' 72 67 65 74
1297 0523' 20 73 79 73
1298 0529' 74 65 6D 20
1299 052D' 28
1300 052E' 081F DW TARADR
1301 0530' 29 DB ''
1302 0531' CACA DW 0CACAH
1303 0533' 4D 65 6D 6F DB 'Memory Commands:'
1304 0537' 72 79 20 43
1305 0538' 6F 6D 6D 61
1306 053F' 6E 64 73 3A
1307 0543' CA DB 0CAH
1308 0544' 20 2E 4D 6F DB ' .Move; .Verify; .Ram Test'
1309 0548' 76 65 3B 20
1310 054C' 2E 56 65 72
1311 0550' 69 66 79 3B
1312 0554' 20 2E 52 61
1313 0558' 6D 20 54 65
1314 055C' 73 74
1315 055E' CA DB 0CAH
1316 055F' 20 21 4D 61 DB ' ?Maaaa dd; '
1317 0563' 61 61 61 20
1318 0567' 64 64 3B 20
1319 0568' 20
1320 056C' 20 3F 4D 61 DB ' ?Maaaa ddd'
1321 0570' 61 61 61 20
1322 0574' 6E 6E 6E 6E
1323 0578' CA DB 0CAH
1324 0579' 20 4D 65 6D DB ' Memory protect'
1325 057D' 6F 72 79 20
1326 0581' 70 72 6F 74
1327 0585' 65 63 74
1328 0588' CA DB 0CAH
1329 0589' 20 3F 43 76 DB ' ?Crc calc'
1330 058D' 63 20 63 61
1331 0591' 6C 63
1332 0593' CAPP DW 0CAFPH
1333 0595' C0 008E' LBR PROMPT
1334 ;
1335 ;
1336 ;*****
1337 ;
1338 ;***** MEMORY PROTECT AND ENABLE *****
1339 ;
1340 0598' MEMSAV: CALL TTY ;TYPE: (text)
1341 0598' D4 +
1342 0599' 0190' +
1343 0598' 65 6D 6F 72 DB 'emory - '
1344 059F' 79 20 2D 20

MACRO-18 3.36 PAGE 1-24
 BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

```

1345 05A3' 50 72 6F 74          DB 'Protect or Enable'
1346 05A7' 65 63 74 20
1347 05AB' 6F 72 20 45
1348 05AF' 6E 61 62 6C
1349 05B3' 65
1350 05B4' 20 28 50 20          DB '(P or E) ? '
1351 05B8' 6F 72 20 45
1352 05BC' 29 20 3F 20
1353 05C0' 03FF                 DW 03FFF ; STX, DONE
1354                               CALL TSRE?
1355 05C2' D4                  +
1356 05C3' 023A'               +
1357                               CALL ITB ;CALL INPUT TEST AND BRANCH
1358 05C5' D4                  +
1359 05C6' 0180'               +
1360 05C8' 50                  DB 'P' ; IF P, GO TO PTECT
1361 05C9' 05DA'               DW PTECT
1362 05CB' 45                  DB 'E' ; IF E, GO TO ENABLE
1363 05CC' 05D2'               DW ENABLE
1364 05CE' FF                  DB OFFH
1365 05CF' C0 008E'            LBR PROMPT ;GO TO PROMPT IF NOT P OR E
1366 ;
1367 05D2' F8 00               ENABLE: LDI 00
1368 05D4' BB                  PHI RB
1369 05D5' F8 01               LDI 01
1370 05D7' AB                  PLO RB ;SET PROTECT FLAG
1371 05D8' 30 DE'              BR SETPG
1372 05DA' F8 00               PTECT: LDI 00
1373 05DC' AB                  PLO RB
1374 05DD' BB                  PHI RB ;SET ENABLE
1375 05DE'                   SETPG: CALL TTY ;TYPE: CR, LF, (text)
1376 05DS' D4                  +
1377 05DF' 019D'               +
1378 05E1' CA                  DB JOAH
1379 05E2' 46 72 6F 6D          DB 'From page '
1380 05E6' 20 70 61 67
1381 05EA' 65 20
1382 05EC' 03                  DB ETX
1383 05ED' 9DFF                DW 9DFFF ; IN4D, DONE
1384 05EF' 8D                  GLO RD
1385 05FO' BE                  PHI RE ;SET CURRENT PAGE
1386                               CALL TTY
1387 05F1' D4                  +
1388 05F2' 019D'               +
1389 05F4' 6F 76 65 72          DB 'over ' ;TYPE: (text)
1390 05F8' 20
1391 05F9' 03                  DB ETX ; STX
1392 05FA' 9D                  DB 09DH ; IN4D,
1393 05FB' 20 70 61 67          DB ' pages.' ; pages..
1394 05FF' 65 73 2E
1395 0602' 03FF                DW 03FFF ; STX, DONE
1396 0604' 8D                  GLO RD
1397 0605' AC                  PLO RC
1398 0606' C6                  LSNZ
1399 0607' FC 01               ADI 01
1400 0609' AC                  PLO RC
  
```

MACRO-18 3.36
BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

1401 CALL MEMCHG
1402 060A' D4 +
1403 060B' 0616' +
1404 060D' C0 008E' LBR PROMPT
1405 ;
1406 ;
1407 ;***** MEMORY PROTECT OR ENABLE SUBROUTINE *****
1408 ;
1409 ;
1410 0610' 46 MEMSUB: LDA LIST ;PASS ENABLE BIT
1411 0611' AB PLO RB
1412 0612' 46 LDA LIST ;PASS START PAGE
1413 0613' BE PHI RE
1414 0614' 46 LDA LIST ;PASS # OF PAGES
1415 0615' AC PLO RC
1416 ;
1417 0616' E3 MEMCHG: SEX PC ;SELECT SYSTEM I/O GROUP
1418 0617' 61 OUT GROUP
1419 0618' 07 DB SYSTEM
1420 ;
1421 0619' BE NEXPG: GLO RC
1422 061A' 8C BZ NDONE
1423 061B' 32 39' GHI RE ;ALWAYS ENABLE:
1424 061D' 9E KRI STKPG ; STACKPAGE
1425 061E' FB 57 BZ SETQ
1426 0620' 32 2C' GHI RE
1427 0622' 9E XRI GLOPG ; GLOBAL PAGE
1428 0623' FB 56 BZ SETQ
1429 0625' 32 2C' GLO RB
1430 0627' 3B BNZ SETQ ;PROTECT OR ENABLE ?
1431 0628' 3A 2C' REQ ; PROTECT -> Q = 0
1432 062A' 7A SKP
1433 062B' 38 SETQ: SEQ ; ENABLE -> Q = 1
1434 062C' 7B OUT MEMORY ;I/O = MEM. PROTECT
1435 062D' 67 REQ
1436 062E' 7A GHI RE
1437 062F' 98 ADI J1
1438 0630' FC 01 PHI RE
1439 0632' BE GLO RC
1440 0633' 8C SHI J1
1441 0634' FF J1 PLO RC
1442 0636' AC BR NEXPG
1443 0637' 30 1A'
1444 ;
1445 0639' F8 JA MDONE: LDI LOW GRPSAV ;SELECT JART I/O GROUP
1446 063B' A7 PLO GPAGE ; AND STORE ON GLOBAL PAGE
1447 063C' F8 06 LDI UARTS
1448 063E' 57 STR GPAGE
1449 063F' E7 SEX GPAGE
1450 0640' 61 OUT GROUP
1451 EXIT
1452 0641' D5 +
1453 ;
1454 ;
1455 ;***** RAM TEST ROUTINE *****
1456 ;

MACRO-18 3.36
BTU SAIL MONITOR 20 FEB 1986 BTU2.MAC

1457 0642' RAMTST: CALL TTY
1458 0642' D4 +
1459 0643' 019D' +
1460 0645' CA DB 0CAH
1461 0646' 52 61 6D 20 DB 'Ram test - start at '
1462 064A' 74 65 73 74
1463 064E' 20 2D 20 73
1464 0652' 74 61 72 74
1465 0656' 20 61 74 20
1466 065A' 03 DB ETX
1467 065B' 9DFF DW 9DFFH
1468 065D' 9D GHI RD ;Start address to R8
1469 065E' BB PHI RB
1470 065F' 8D GLO RD
1471 0660' AB PLO RB
1472 ;
1473 CALL TTY
1474 0661' D4 +
1475 0662' 019D' +
1476 0664' 20 4F 56 45 DB ' OVER '
1477 0668' 52 20
1478 066A' 03 DB ETX
1479 066B' 9DFF DW 9DFFH
1480 ;
1481 066D' 9F LDSET: GHI RF ;Get rand key from RF
1482 066E' 83 PHI R8
1483 ;
1484 066F' 9B GHI RB ;Start address to R8
1485 0670' 39 PHI R9
1486 0671' 3B GLO RB
1487 0672' A9 PLO R9
1488 ;
1489 0673' 9D GHI RD ;Length to RA
1490 0674' BA PHI RA
1491 0675' 8D GLO RD
1492 0676' AA PLO RA
1493 ;
1494 0677' LDLOOP: CALL RAND
1495 0677' D4 +
1496 0678' 06CA' +
1497 ;
1498 067A' 98 GHI R8
1499 067B' 59 STR R9
1500 067C' 19 INC R9
1501 067D' 2A DEC RA
1502 067E' 3A GLO RA
1503 067F' 3A 77' BNZ LDLOOP
1504 0681' 9A GHI RA
1505 0682' 3A 77' BNZ LDLOOP
1506 ;
1507 ;
1508 0684' 9F CHKSET: GHI RF
1509 0685' 88 PHI R8
1510 0686' 9B GHI RB
1511 0687' 89 PHI R9
1512 0688' 8B GLO RB

MACRO-18 3.36
BTU SAIL MONITOR PAGE 1-27
20 FEB 1986 BTU2.MAC

1513	0689'	A9	PLO R9
1514	068A'	9D	GHI RD
1515	068B'	3A	PHI RA
1516	068C'	8D	GLO RD
1517	068D'	AA	PLO RA
1518	068E'	-	CHK: CALL RAND
1519	068E'	D4	-
1520	068F'	06CA'	-
1521	0691'	39	SEX R9
1522	0692'	98	GHI R8
1523	0693'	F3	XOR
1524	0694'	3A AD'	BNZ ERRSLST
1525	0696'	19	CONTI: INC R9
1526	0697'	2A	DEC RA
1527	0698'	3A	GLO RA
1528	0699'	3A BE'	BNZ CHK
1529	069B'	3A	GHI RA
1530	069C'	3A BE'	BNZ CHK
1531	-	-	;
1532	069E'	9F	PASSDN: GHI RF
1533	069F'	38	PHI R8
1534	-	-	CALL RAND
1535	06A0'	D4	-
1536	06A1'	06CA'	-
1537	06A3'	98	GHI R8
1538	06A4'	3F	PHI RF
1539	-	-	CALL TTY
1540	06A5'	D4	-
1541	06A6'	019D'	-
1542	06A8'	2A	DB '1'
1543	06A9'	00FF	DB DONE
1544	06AB'	30 6D'	BR LDSET
1545	-	-	;
1546	06AD'	A8	ERRSLST: PLO R8
1547	-	-	CALL TTY
1548	06AE'	D4	-
1549	06AF'	019D'	-
1550	06B1'	C AFF	DB 0CAFHH
1551	06B3'	38	GLO R8
1552	06B4'	BD	PHI RD
1553	-	-	CALL TTY
1554	06B5'	D4	-
1555	06B6'	019D'	-
1556	06B8'	31	DB 081H
1557	06B9'	20 61 74 20	DB ' at '
1558	06BD'	FF	DB OFFH
1559	06BE'	99	GHI R9
1560	06BF'	BD	PHI RD
1561	06C0'	39	GLO R9
1562	06C1'	AD	PLO RD
1563	-	-	CALL TTY
1564	06C2'	D4	-
1565	06C3'	019D'	-
1566	06C5'	8181	DB 8181H
1567	06C7'	FF	DB OFFH
1568	06C8'	30 96'	BR CONTI

MACRO-18 J.36
BTU SAIL MONITOR PAGE 1-28
20 FEB 1986 BTU2.MAC

1569 ;
1570 ;
1571 06CA' F8 00 REND: LDI 00
1572 06CC' A8 PLO R8
1573 06CD' 98 GHI R8
1574 06CE' 3A D3' BNZ CNO
1575 06DD' F8 FF LDI OFFH
1576 06D2' 88 PHI R8
1577 06D3' F6 ON0: SHR
1578 06D4' 3B D7' BNF ON1
1579 06D6' 18 INC R8
1580 06D7' F6 ON1: SHR
1581 06D8' F6 SHR
1582 06D9' 3B DC' BNF ON2
1583 06DB' 13 INC R8
1584 06DC' F6 ON2: SHR
1585 06DD' 3B E0' BNF ON3
1586 06DF' 13 INC R8
1587 06E0' F6 ON3: SHR
1588 06E1' 3B E4' BNF ON4
1589 06E3' 18 INC R8
1590 06E4' 88 ON4: GLO R8
1591 06E5' F6 SHR
1592 06E6' 98 GHI R8
1593 06E7' F6 RSHR
1594 06E3' 38 PHI R8
1595 EXIT
1596 06E9' 05
1597 ;
1598 ;
1599 LIST
1600 ;
1601 END

MACRO-18 3.36
BTU SAIL MONITOR PAGE S
 20 FEB 1986 BTU2.MAC

MACROS:

BCI	BXI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSMB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRST	STM	STPC	TCAL	TRET	XID	XIZ

SYMBOLS:

ASCHEX	0118'	ASCRD1	01AC'	BANGGR	00D4'	BR1ST	009B'
BTU	0000	CALL	0066'	CHK	068E'	CHKSET	0684'
CLCOP1	0479'	CNVRT	010E'	CONT1	0696'	CRC	0453'
CRCHI	5606	CRCLO	5607	CRCRAM	5605	CRCSUB	04BB'
CTOP	0065'	CTRL1	0003	CTRL2	0005	CTRL3	0007
CYCCNT	0008	DATA1	0002	DATA2	0004	DATA3	0006
DECCNT	028D'	DELAY2	0150'	DLY00	0040'	DMA	0000
DONE	00FF	DOTGR	00B7'	ENABLE	05D2'	ERRLST	06AD'
ERROR	02F3'	ETX	0003	FINIS	003A'	FORMT1	0012
GLOPG	0056	GP	5600	GPAGE	0007	GROUP	0001
GRPSAV	560A	GTR9	0230'	HALT	0006	HDSTRT	0000'
HELP	04E0'	HEXRD1	01BA'	HXCONV	0222'	INS	0432'
IN1ST	02D6'	IN2ND	02E3'	IN4D	00FD'	IN4D2	0101'
IN4DT?	0234'	IN4RET	010D'	INADDR	02C0'	INCHAR	00B1'
INKWD	015C'	INLF	032D'	INTPC	0001	IOERR	0082'
IOLOC	56FE	ITB	0180'	KEEP2	00ED'	LDLOOP	0677'
LDSET	066D'	LIST	0006	LNEND	02AF'	LNTEST	02A6'
MATCH	0171'	MATCH2	0196'	MDONE	0639'	NEMCHG	0616'
MEMORY	0007	MEMSAV	0598'	MEMSUB	0610'	MENAB	0017'
MCV	0369'	MOVE	0336'	MOVRTN	0378'	NEWPG	001B'
NEXBYT	0286'	NEXPG	061A'	NEXT2	0184'	NEXT3	01A0'
NO	0424'	NOTHEX	0137'	NUMBER	0130'	OK?	0407'
OKRTN	0421'	ONO	06D3'	ON1	06D7'	ON2	06DC'
ON3	06E0'	ON4	06E4'	OUTADR	0274'	OUTASC	021C'
OUTCA	01B1'	OUTCHR	0249'	OUTHEX	01BF'	OUTPT1	021E'
OUTPT2	01B0'	PASSCA	0324'	PASSDN	069E'	PC	0003
PILEVEL	5602	P LIST	0162'	PNTCHR	003B'	PROM1	0008
PROMPT	008E'	PTECT	05DA'	QUESGR	00C7'	QUESTM	025D'
RAMTST	0642'	RAND	06CA'	RBHI	5608	RBLO	5609
READDR	0085'	RTN	0076'	RTNPTR	0006	RTOP	0075'
RUN	03F5'	SAYCLR	04A3'	SAYNO	03F8'	SCRT	0057'
SCRTST	0056'	SEMI?	0310'	SETPG	05DE'	SETQ	062C'
SETQ1	002D'	SETSL	0007'	SETUP	003D'	SETURT	0047'
SHFTD4	013A'	SHIFT	013F'	STACK	0002	START1	000E'
STAT1	0003	STAT2	0005	STAT3	0007	STKEND	57DF
STKPG	0057	STORE	022B'	SYSFLG	5603	SYSTEM	0007
TARADR	081F	TEST	0188'	TEST\$	0427'	TEST90	01A8'
TEST81	01B5'	TEST8D	01D4'	TEST9D	01E9'	TESTA1	01FD'
TESTA2	020E'	TESTCA	01DD'	TESTCR	031A'	TESTDD	01F2'
TESTSP	02FF'	THRE?	024F'	TMATCH	016B'	TSRE?	023A'
TTY	019D'	UARTS	0006	UNADDR	0084'	VBAD	03C7'
VCONT	03C2'	VERIFY	0378'	VMORE	03BD'	VNEXT	03AB'
WAIT	0043'	WAIT3	0152'	WAIT4	023B'	WRITEM	0287'
YES?	0415'						

NO FATAL ERROR(S)

LIST	48\$	516	519	520	528	529	532	550	559	560	1410
	1412	1414									
LHEND	305	807	809\$								
LNTEST	796	804\$									
MATCH	528\$										
MATCH2	558	562\$									
MDONE	1423	1445\$									
MENCHG	1403	1417\$									
MEMORY	89\$	196	1435								
MEMSAV	344	1340\$									
MEMSUB	1410\$										
MENAB	178\$										
MOV	952\$	957	959								
MOVE	357	918\$									
MOVERTH	964\$										
NEWPG	183\$	204									
NEXBYT	785\$	798	803								
NEXPG	1422\$	1443									
NEXT2	550\$	561									
NEXT3	577\$	592	619	635	642	661	671				
NO	1108	1113\$									
NOTHEX	449	455	458	468\$							
NUMBER	452	462\$									
OK?	949	1089\$	1143								
OKRTH	1110\$										
ONO	1574	1577\$									
ON1	1578	1580\$									
ON2	1582	1584\$									
ON3	1585	1587\$									
ON4	1588	1590\$									
OUTADR	767\$	813									
OUTASC	664	673\$									
OUTCA	630\$										
OUTCHR	591	687	725\$	730							
OUTHEX	601\$	626									
OUTPT1	648	675\$									
OUTPT2	589\$	676									
PASSCA	887	893	900\$	905							
PASSDN	1532\$										
PC	44\$	166	168	178	206	237	241	263	269	271	274
	281	283	285	1417							
PLEVEL	132\$										
PLIST	516\$	518	527								
PMTCHR	148\$	320									
POP	30\$										
PPAGE	30\$										
PROM1	107\$										
PROMPT	313\$	348	363	378	392	788	808	878	898	950	964
	1083	1144	1217	1228	1333	1365	1404				1014

Appendix M

The following program was written for a Hewlett - Packard HP-16C calculator. It is used to convert data in the Sea Duct buffer to engineering units. Before running the program, Calculator Register .0 must contain the A/D GND value and Register F must contain the A/D +5V value. The calculator must be placed in the HEX mode before each conversion.

Calculator subroutines A, B, C and D are run to give the following conversions:

A = A/D conversion (12 bit)	C = Compass conversion
B = Battery conversion (8 bit)	D = Pendulum conversion

For example to convert an A/D value of 3F8 to engineering units, (assume A/D GND = 009 [R.0] and A/D +5V = FE1 [R F.])

1. Press HEX
2. Enter 3F8 - There is no need to hit ENTER
3. Press GSB A
4. Read the answer in the appropriate units (1.24063 Volts for this example).

To convert a compass value of 2C to degrees,

1. Press HEX
2. Enter 2C - There is no need to hit ENTER
3. Press GSB C
4. Read the answer in the appropriate units (61.88 degrees for this example).

HP 16C - Sea Duct Programs

A = A/D conversion (12 Bit)	HEX to Volts
B = Battery conversion (8 bit)	HEX to Volts
C = Compass	HEX to Degrees
D = Pendulum	HEX to Degrees

Note: First store A/d GND in R0, A/D +5V in RF in HEX mode

			A/D Program
001	43,22, A	LBL-A	
002	21, 8	GSB 8	
003	4	4	
004	48	.	
005	9	9	
006	9	9	
007	7	7	
008	20	X	
009	43,21	g RTN	

Appendix M (contd.)

010	43, 22, B	LBL-B	Battery Program
011	21, 9	GBS 9	
012	21, 8	GBS 8	
013	3	3	
014	0	0	
015	20	X	
016	43, 21	g RTN	
017	43, 22, C	LBL-C	Compass Program
018	42, 3	f UNSGN	
019	36	Enter	
020	0	0	
021	42, 45, 2	f float 2	
022	3	3	
023	6	6	
024	0	0	
025	20	X	
026	2	2	
027	5	5	
028	6	6	
029	10	:	
030	43, 21	g RTN	
031	43, 22, D	LBL-D	Pendulum Program
032	36	Enter	
033	0	0	
034	42, 45, 2	f float 2	
035	2	2	
036	20	X	
037	4	4	
038	5	5	
039	30	-	
040	43, 21	g RTN	
041	43, 22, 8	LBL-8	Scale 12 bit #(HEX) to Decimal Routine
042	42, 3	f UNSGN	
043	36	Enter	
044	45,.0	Rcl.0 (Recall A/D Gnd)	
045	30	-	
046	36	Enter	
047	0	0	
048	42, 45, 2	f float 2	
049	44,.1	Store .1	
050	23	HEX	
051	45, F	Rcl F. (Recall A/D +5V)	
052	36	Enter	

Appendix M (contd.)

053	45,.0	Rcl.0
054	30	-
055	0	0
056	42,45, 2	f float 2
057	45,.1	Recall .1
058	34	XY
059	10	#
060	42,45, 5	f float 5
061	43,21	g RTN
062	43,22, 9	LBL-9 8 bit to 12 bit conversion routine
063	42, A	f SL
064	42, A	f SL
065	42, A	f SL
066	42, A	F SL
067	43,21	g RTN

APPENDIX N

SEA DUCT PRE-LAUNCH CHECK LIST

Deployment Date _____

Location _____

Depth _____

1. MAIN BATTERY PACKS

<u>Pack #1</u>	<u>Initial</u>
A. Safety Chain On _____ Off _____	_____
B. Top of Compensation Oil (Marcol)	_____
C. Check water sump drain plugs for security	_____
D. Tie wrap any loose hoses or electrical cables	_____
E. Check microprocessor for security in cradle	_____
F. Check microprocessor compensation diaphragm for top off (Marcol)	_____
G. Check microprocessor electrical plugs for full seating, milk air from connector if necessary	_____
H. Check microprocessor electrical cables; tie wrap if necessary	_____
I. Check all tea cup diaphragms for leakage at wires and seals. Top off as required (5 places) White (Marcol) Red (Mil H5606 Hyd. fluid)	_____ _____ _____ _____
J. Back fill battery disconnect with (Marcol) Use disconnect at base of battery to force all air thru plastic check valve. Reconnect to drain fitting	_____
K. Remove battery gas vent line	_____
L. Install disconnect plug in battery gas vent fitting	_____
M. Remove overflow can	_____
N. Check pinger battery voltage	_____
O. Reset pinger and reinstall dummy plugs	_____

<u>Pack #2</u>	<u>Initial</u>
A. Safety Chain On _____ Off _____	_____
B. Top of Compensation Oil (Marcol)	_____
C. Check water sump drain plugs for security	_____
D. Tie wrap any loose hoses or electrical cables	_____
E. Check emergency battery pack for security in cradle	_____
F. Check EHRS battery voltage Check MP battery voltage	_____
G. Check emergency battery wiring and plugs for proper seating, milk air if necessary, cap unused plugs and wires	_____
H. Check all tea cup diaphragms for leakage at wires and seals, top off as required (3 places) white (Marcol) red (Mil H5606 Hyd. fluid)	_____ _____ _____
I. Back fill battery disconnect with (Marcol) Use disconnect at base of battery to force all air thru plastic check valve. Reconnect at drain fitting	_____
J. Remove battery gas vent line	_____
K. Install disconnect plug in battery gas vent fitting	_____
L. Remove overflow can	_____

<u>Pack #3</u>	<u>Initial</u>
A. Safety Chain On _____ Off _____	_____
B. Top of Compensation Oil (Marcol)	_____
C. Check water sump drain plugs for security	_____
D. Tie wrap any loose hoses or electrical cables	_____
E. Check emergency release control canister for security in cradle	_____
F. Check emergency release wiring and plugs for proper seating, milk air if necessary, cap unused plugs and wires	_____
G. Check cylindrical vertical reservoir for security in cradle	_____
H. Check all 1/8 inch st/sl tube and gland nuts for tightness	_____
I. Back fill relief valve vent tube loop with oil (Marcol)	_____
J. Check all electrical cables for security, tie wrap if necessary	_____
K. Check all tea cup diaphragms for leakage at wires and seals. Top off as required (4 places) white (Marcol) red (Mil H5606 Hyd fluid)	_____ _____ _____
L. Back fill battery disconnect with (Marcol) Use disconnect at base of battery to force all air thru plastic check valve. Reconnect at drain fitting	_____
M. Remove battery gas vent line	_____
N. Install disconnect plug in battery gas vent fitting	_____
O. Remove overflow can	_____
P. Check pinger battery voltage	_____
Q. Reset pinger and reinstall dummy plugs	_____

Hydraulic CanisterInitial

- A. Top off canister with (Marcol) _____
- B. Check all seals and fittings for leakage _____
- C. Check all electrical cables for leakage at Dancos _____
- D. Check all electrical cable for security; tie wrap as necessary _____
- E. Back fill relief valve hose loop with (Marcol) _____
- F. Remove top vent line from over flow can; plug male disconnect into female disconnect on PVC relief valve mounting block _____
- G. Disconnect compensation regulator sense line at canister base, plug in free flow male disconnect fitting to assure regulator feels ambient sea water pressure _____
- H. Install dead ended female disconnect into sump sense line male fitting _____
- I. Open valve at N₂ compensation accumulator.
1/2 to 3/4 turn is sufficient. Do not open further;
a stem leak could occur.

Relay Canisters

- A. Check all seals and fittings for leakage _____
- B. Check all electrical cables for leakage at Dancos _____
- C. Check all electrical cables for security; tie wrap as required _____
- D. Top off all canisters as necessary (use Marcol) _____

Main Junction BoxInitial

- A. Check all seals and fittings for leakage _____
- B. Check all electrical cables for leakage at Dancos _____
- C. Check all electrical cables for security; tie wrap as required _____
- D. Top off all canisters as necessary (use Marcol) _____
- E. Insure all functions are "off" on external manual control. Remove external test box plug. Clean 'O' ring and install test plug cap. Be sure 'T' handle plug is centered; a leak will occur if the plug is not centered in the step machined in the cap ring. Install dummy plug on 4-bin Brantner connector. _____

N₂ Compensation Systems

- A. Pressurize recirculating pump motor accumulators with 3,000+ psi N₂ _____
- B. Pressurize hydraulic pump motor with 3,000+ PSI N₂ _____
- C. Check all lines and valves for leakage _____
- D. Back fill accumulator diaphragms with water base hydraulic fluid as required _____

Insert/Retract System

- A. Check hydraulic cylinders and hoses for leaks _____
- B. Check cable and turnbuckler for security and freedom of motion _____
- C. Check cable to assure they do not hang slack; adjust if necessary _____
- D. Remove 3 lock clamps _____

Interface Junction Boxes (5" x 9")

- A. Check for fluid leakage at seals, wires and dancos _____
- B. Back fill with (Marcol)
Four located on rotary frame A _____ B _____ D _____ G _____
Three located on main structure C _____ E _____ F _____

Bottom Contact Switches Initial

- A. Check for freedom of motion and smooth operation
- 1. One bottom contact switch with contact weight
- 2. One rotary frame retract switch
- 3. Four test section insert switches

Hydraulic System Accumulators

- A. Check accumulators for leakage at fittings and diaphragms
- B. Cylindrical accumulator has piston with (Red Mil H5606) on system side, (water base hydraulic fluid in flexible diaphragm)
- C. Flexible accordion diaphragm assembly has (red Mil H5606 hydraulic fluid only). Replaceable filters are located in the upper PVC cap.

Water Vent Flapper Tees

- A. Check flapper valve freedom of motion (8 flappers)

Window and Lens Cleaning

- A. Clean camera lens
- B. Clean transmissometer glass
- C. Remove plywood safety covers from test section top
- D. Clean upper test section glass
- E. Clean side ports in test section
- F. Clean photo flash port

Rotary Mechanism

- A. Check hydraulic cylinders and hoses for leakage
- B. Check drive chains for lubricant
- C. Check F/G cover cap for security

<u>Camera System</u>	<u>Initial</u>
A. Charge camera battery pack	_____
B. Install film, set data chamber	_____
C. Charge photo flash battery pack	_____
D. Install assemblies on x-y-z traverse mechanism	_____
E. Install control cables; tie wrap as required	_____
F. Turn on switch	_____
<u>Water Samplers</u>	
A. Hydro products butter-fly	
1. Install bag	_____
2. Cock mechanism	_____
3. Hook up sample tube at test section port	_____
4. Remove safety clamp	_____
B. Hydro products chop-stik baggie	
1. Install bag	_____
2. Wind up spring mechanism	_____
3. Cock latch mechanism	_____
<u>Sediment Samples (two)</u>	
1. Retract hydraulic cylinder until it bottoms out	_____
2. Retract closure doors; install safety lock link (two) CAUTION—Do not put hands or fingers into opening at base of sampler.	_____
3. Install release cable loop eyes on release pins	_____
4. Rotate release pin mechanism until cable eyes are secure	_____
5. Carefully remove safety lock link	_____

Battery Charge Junction Box (A)Initial

1. Check penetrator caps (4) for full seating; milk air from connector cap if necessary (4 places)

Shore Power Junction Box (B)

1. Check penetrator cap (1) for full seating; milk air if necessary; check Danco connectors

Recirculating Pump Motors (two)

1. Check Danco electrical plugs for security
2. Check plastic N₂ compensation line for collapse water tie wraps; correct if required
3. Check plastic N₂ compensation line for cracks at inlet fitting to motor
4. Open valve at N₂ compensation accumulator, 1/2 to 3/4 turn is sufficient. Do not open further; a stem leak could occur.

Hydraulic Flow Dividers (two at center line of structure)

1. Visually inspect cylindrical PVC housings and large top hat bladder for leakage
2. Check tube fittings at top of both assemblies for leakage
3. Top off compensation fluid in both assemblies; use Mil-H-5606 (Red)

Recirculating Pump Motor Controller

1. Check electrical plugs for proper seating; milk air from caps if necessary
2. Check mechanical security of pressure housing